Nokia Customer Care

Service Manual

RM-243 (Nokia 6120 classic; L3&4)
Mobile Terminal
Part No: 9203974 (Issue 1)

COMPANY CONFIDENTIAL

NOKIA
Care

Amendment Record Sheet

Amendment No	Date	Inserted By	Comments
Draft 1	03/2007	ET	
Issue 1	05/2007	ET	

Copyright

Copyright © 2007 Nokia. All rights reserved.

Reproduction, transfer, distribution or storage of part or all of the contents in this document in any form without the prior written permission of Nokia is prohibited.

Nokia, Nokia Connecting People, and Nokia X and Y are trademarks or registered trademarks of Nokia Corporation. Other product and company names mentioned herein may be trademarks or tradenames of their respective owners.

Nokia operates a policy of continuous development. Nokia reserves the right to make changes and improvements to any of the products described in this document without prior notice.

Under no circumstances shall Nokia be responsible for any loss of data or income or any special, incidental, consequential or indirect damages howsoever caused.

The contents of this document are provided "as is". Except as required by applicable law, no warranties of any kind, either express or implied, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose, are made in relation to the accuracy, reliability or contents of this document. Nokia reserves the right to revise this document or withdraw it at any time without prior notice.

The availability of particular products may vary by region.

IMPORTANT

This document is intended for use by qualified service personnel only.

Warnings and cautions

Warnings

- IF THE DEVICE CAN BE INSTALLED IN A VEHICLE, CARE MUST BE TAKEN ON INSTALLATION IN VEHICLES FITTED WITH ELECTRONIC ENGINE MANAGEMENT SYSTEMS AND ANTI-SKID BRAKING SYSTEMS. UNDER CERTAIN FAULT CONDITIONS, EMITTED RF ENERGY CAN AFFECT THEIR OPERATION. IF NECESSARY, CONSULT THE VEHICLE DEALER/ MANUFACTURER TO DETERMINE THE IMMUNITY OF VEHICLE ELECTRONIC SYSTEMS TO RF ENERGY.
- THE PRODUCT MUST NOT BE OPERATED IN AREAS LIKELY TO CONTAIN POTENTIALLY EXPLOSIVE ATMOSPHERES, FOR EXAMPLE, PETROL STATIONS (SERVICE STATIONS), BLASTING AREAS ETC.
- OPERATION OF ANY RADIO TRANSMITTING EQUIPMENT, INCLUDING CELLULAR TELEPHONES, MAY INTERFERE WITH THE FUNCTIONALITY OF INADEQUATELY PROTECTED MEDICAL DEVICES. CONSULT A PHYSICIAN OR THE MANUFACTURER OF THE MEDICAL DEVICE IF YOU HAVE ANY QUESTIONS. OTHER ELECTRONIC EQUIPMENT MAY ALSO BE SUBJECT TO INTERFERENCE.
- BEFORE MAKING ANY TEST CONNECTIONS, MAKE SURE YOU HAVE SWITCHED OFF ALL EQUIPMENT.

Cautions

- Servicing and alignment must be undertaken by qualified personnel only.
- Ensure all work is carried out at an anti-static workstation and that an anti-static wrist strap is worn.
- Ensure solder, wire, or foreign matter does not enter the telephone as damage may result.
- Use only approved components as specified in the parts list.
- Ensure all components, modules, screws and insulators are correctly re-fitted after servicing and alignment.
- Ensure all cables and wires are repositioned correctly.
- Never test a mobile phone WCDMA transmitter with full Tx power, if there is no possibility to perform the measurements in a good performance RF-shielded room. Even low power WCDMA transmitters may disturb nearby WCDMA networks and cause problems to 3G cellular phone communication in a wide area.
- During testing never activate the GSM or WCDMA transmitter without a proper antenna load, otherwise GSM or WCDMA PA may be damaged.

ESD protection

Nokia requires that service points have sufficient ESD protection (against static electricity) when servicing the phone.

Any product of which the covers are removed must be handled with ESD protection. The SIM card can be replaced without ESD protection if the product is otherwise ready for use.

To replace the covers ESD protection must be applied.

All electronic parts of the product are susceptible to ESD. Resistors, too, can be damaged by static electricity discharge.

All ESD sensitive parts must be packed in metallized protective bags during shipping and handling outside any ESD Protected Area (EPA).

Every repair action involving opening the product or handling the product components must be done under ESD protection.

ESD protected spare part packages MUST NOT be opened/closed out of an ESD Protected Area.

For more information and local requirements about ESD protection and ESD Protected Area, contact your local Nokia After Market Services representative.

Care and maintenance

This product is of superior design and craftsmanship and should be treated with care. The suggestions below will help you to fulfil any warranty obligations and to enjoy this product for many years.

- Keep the phone and all its parts and accessories out of the reach of small children.
- Keep the phone dry. Precipitation, humidity and all types of liquids or moisture can contain minerals that will corrode electronic circuits.
- Do not use or store the phone in dusty, dirty areas. Its moving parts can be damaged.
- Do not store the phone in hot areas. High temperatures can shorten the life of electronic devices, damage batteries, and warp or melt certain plastics.
- Do not store the phone in cold areas. When it warms up (to its normal temperature), moisture can form inside, which may damage electronic circuit boards.
- Do not drop, knock or shake the phone. Rough handling can break internal circuit boards.
- Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the phone.
- Do not paint the phone. Paint can clog the moving parts and prevent proper operation.
- Use only the supplied or an approved replacement antenna. Unauthorised antennas, modifications or attachments could damage the phone and may violate regulations governing radio devices.

All of the above suggestions apply equally to the product, battery, charger or any accessory.

Company Policy

Our policy is of continuous development; details of all technical modifications will be included with service bulletins.

While every endeavour has been made to ensure the accuracy of this document, some errors may exist. If any errors are found by the reader, NOKIA MOBILE PHONES Business Group should be notified in writing/e-mail.

Please state:

- Title of the Document + Issue Number/Date of publication
- Latest Amendment Number (if applicable)
- Page(s) and/or Figure(s) in error

Please send to:

NOKIA CORPORATION
Nokia Mobile Phones Business Group
Nokia Customer Care
PO Box 86
FIN-24101 SALO
Finland
E-mail: Service.Manuals@nokia.com

Battery information

Note: A new battery's full performance is achieved only after two or three complete charge and discharge cycles!

The battery can be charged and discharged hundreds of times but it will eventually wear out. When the operating time (talk-time and standby time) is noticeably shorter than normal, it is time to buy a new battery.

Use only batteries approved by the phone manufacturer and recharge the battery only with the chargers approved by the manufacturer. Unplug the charger when not in use. Do not leave the battery connected to a charger for longer than a week, since overcharging may shorten its lifetime. If left unused a fully charged battery will discharge itself over time.

Temperature extremes can affect the ability of your battery to charge.

For good operation times with Ni-Cd/NiMh batteries, discharge the battery from time to time by leaving the product switched on until it turns itself off (or by using the battery discharge facility of any approved accessory available for the product). Do not attempt to discharge the battery by any other means.

Use the battery only for its intended purpose.

Never use any charger or battery which is damaged.

Do not short-circuit the battery. Accidental short-circuiting can occur when a metallic object (coin, clip or pen) causes direct connection of the + and - terminals of the battery (metal strips on the battery) for example when you carry a spare battery in your pocket or purse. Short-circuiting the terminals may damage the battery or the connecting object.

Leaving the battery in hot or cold places, such as in a closed car in summer or winter conditions, will reduce the capacity and lifetime of the battery. Always try to keep the battery between 15°C and 25°C (59°F and 77°F). A phone with a hot or cold battery may temporarily not work, even when the battery is fully charged. Batteries' performance is particularly limited in temperatures well below freezing.

Do not dispose of batteries in a fire!

Dispose of batteries according to local regulations (e.g. recycling). Do not dispose as household waste.

Nokia 6120 classic; L3&4 Service Manual Structure

1 General Information
2 Service Tools and Service Concepts
3 BB Troubleshooting and Manual Tuning Guide
4 RF troubleshooting
5 Camera Module Troubleshooting
6 System Module and User Interface
Glossary

(This page left intentionally blank.)

1 — General Information

(This page left intentionally blank.)

Table of Contents

Product selection 1–5
Product features and sales package 1–5
Product and module list 1–7
Mobile enhancements 1–7
Technical specifications 1–9
  Transceiver general specifications 1–9
  Main RF characteristics for GSM850/900/1800/1900 and WCDMA V (850) and WCDMA I (2100) phones 1–9
  Battery endurance 1–11

List of Tables

Table 1 Audio 1–7
Table 2 Car 1–8
Table 3 Carrying 1–8
Table 4 Data & positioning 1–8
Table 5 Messaging 1–9
Table 6 Music 1–9
Table 7 Power 1–9

List of Figures

Figure 1 View of RM-243 1–5

(This page left intentionally blank.)

Product selection

RM-243 is a GSM/HSDPA/WCDMA tri-mode handportable monoblock phone. It supports EGSM850/900/1800/1900 and WCDMA850/2100 bands, and CSD/HSCSD, GPRS/EGPRS, WCDMA/HSDPA data bearers.

For WCDMA the maximum bit rate is up to 384 kbit/s for downlink and 384 kbit/s for uplink with simultaneous CS speech or CS video (max. 64 kbit/s). The HSDPA peak is 3.6Mbps (with limited use cases).

For GPRS/EGPRS networks the RM-243 is a Class B EGPRS MSC 32 (5 Rx + 3 Tx, max sum 6), which means a maximum download speed of up to 296 kbit/s with EGPRS, and up to 107 kbit/s with GPRS. RM-243 also supports Dual Transfer Mode (DTM) for simultaneous voice and packet data connection in GSM/EDGE networks; simple class A, multi slot class 11, (4 Rx + 3 Tx, max sum 5), UL/DL=236.8/177.6 kbit/s.

RM-243 has a large 2.0'' QVGA (320x240 pixels) TFT display with 16 million colors, a 2 Megapixel main camera that has a 4 x digital zoom and an integrated flash, and a 2nd CIF camera for video calls.

RM-243 is an MMS (Multimedia Messaging Service) enabled multimedia device. The MMS implementation follows the OMA MMS standard release 1.2. RM-243 also supports the Bluetooth 2.0 + EDR standard.

RM-243 uses Symbian (S60, release 3.1) operating system and supports the full Web Browser for S60, which brings desktop-like Web browsing experience to mobile devices.

RM-243 also supports MIDP Java 2.0, providing a good platform for compelling 3rd party applications.

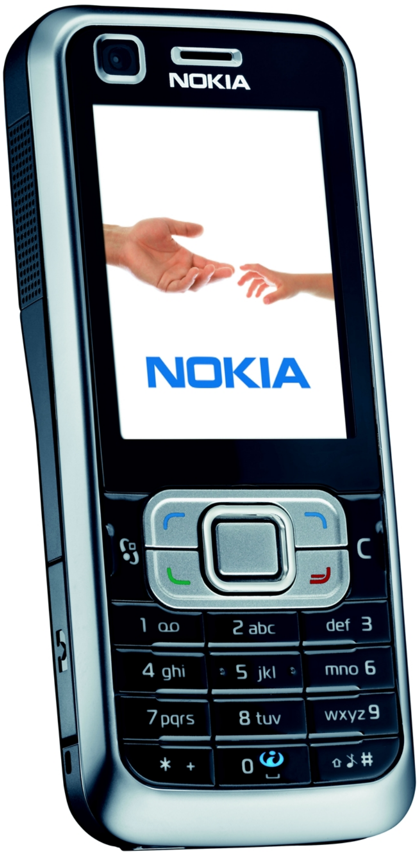


Figure 1 View of RM-243

Product features and sales package

Bearers and transport

- WCDMA DL 384kbit/s, UL 384 kbit/s

- HSDPA up to 3.6Mbps
- GPRS/EGPRS Class B, Multi slot class 32
- Dual Transfer Mode (DTM) class A, multi slot class 11 (4 Rx+3Tx=5)

Connectivity

- Bluetooth 2.0 + EDR (SIM Access, Headset & Handsfree, A2DP profiles)
- USB2.0 Full Speed with mini-USB interface
- MicroSD memory card - support up to 2GB
- 2.5 mm AV Connector

Display

- Large 2.0'' QVGA (320x240 pixels) TFT display with 16 million colors

Imaging and video

- Integrated 2 megapixel digital camera with 4x smooth digital zoom and landscape mode, integrated LED flash.
- 2nd CIF camera for video calls
- Video streaming and playback with H.264 (MPEG4), 3gpp, Real codecs
- Video recording in H.263 (3gpp) and MPEG4
- Video Sharing in 3G networks (SWIS), VS2.2 version

Music

- Music player supporting MP3, MP4, eAAC+ and WMA
- True tones, MP3/AAC and MIDI ringing tones up to 64 polyphonies
- Stereo FM Radio / Visual radio™

Productivity

Context management

- OMA client provisioning
- PIM (Calendar + Contacts)
- OTA provisioning & over the air SW update (FOTA)
- Nokia PC Suite connectivity with USB, Bluetooth
- Active Standby
- Local/remote SyncML data sync
- Web Browser (OSS), Java ™ MIDP 2.0, XHTML browsing over TCP/IP

Messaging

- Common inbox (SMS, MMS), MMS: OMA MMS 1.2
- Push E-mail (IMAP4 idle and OMA EMN) with attachment viewers (Excel, PowerPoint, Word)
- Audio Messaging (AMS)

Voice

- Rich Calls: Push to Talk (PoC), 2-way video conferencing (Video Call), Video Sharing
- Voice commands, enhanced voice dialling (SIND)
- Audio message reader for text messages and E-mail

Add-on software framework

- Symbian 9.x OS
- Nokia Series 60, 3rd edition, feature pack 3.1
- Java: MIDP2.0

Additional technical specifications

- Vibrating alert
- 3GPP Rel 4compliant
- Speech codecs supported in WCDMA: AMR
- Speech codecs supported in GSM: AMR, EFR, FR, HR
- WCDMA HSDPA 2100 MHz with simultaneous voice and packet data (PS max speed DL/UL= 384kbps/ 384kbps, CS max speed 64kbps)
- Dual Transfer Mode (DTM) support for simultaneous voice and packet data connection in GSM/EDGE networks. Simple class A, multi slot class 11, max speed DL/UL: 236.8/177.6kbits/s
- EGPRS class B, multi slot class 32, (5 Rx + 3 Tx / max sum 6), max speed DL/UL= 296 / 177.6 kbits/s
- GPRS class B, multi slot class 32 (5 Rx + 3 Tx / max sum 6), max speed DL/UL= 107 / 64.2 kbits/s

Sales package

- Transceiver RM-243
- Charger (AC-4)
- Battery (BL-5B)
- Stereo headset (HS-47)
- Mini USB connectivity cable (DKE-2)
- CD-ROM
- Short User Guide (full User Guide online + CS help)

Product and module list

Module name	Type code	Notes
System/RF Module	2AR	Main PWB with components.
UI Flex Module	2AS	

Mobile enhancements

Table 1 Audio

Enhancement	Type
Wired headsets	HS-40
	HS-47
	HS-81

Enhancement	Type
Wireless headsets	HDW-3
	HS-4W
	HS-11W
	HS-13W
	HS-21W
	HS-26W
	HS-36W
	HS-37W
Loopsets TTY adapter	HDA-11

Table 2 Car

Enhancement	Type
Mobile holder	CR-39
Mobile holder mounting device	HH-12
Mobile charger	DC-4
Car kit	N616
Wireless car kit	CK-1W
	CK-7W
	CK-20W
Wireless plug-in car handsfree	HF-6W
Car phone	N810
Privacy handset	HSU-4

Table 3 Carrying

Enhancement	Type
Carrying case	xx

Table 4 Data & positioning

Enhancement	Type
MicroSD card, 128MB	MU-26
MicroSD card, 256MB	MU-27
MicroSD card, 512MB	MU-28
MicroSD card, 1GB	MU-22
MicroSD card, 2GB	MU-37

Enhancement	Type
Mini USB connectivity adapter cable	DKE-2
Wireless GPS module	LD-3W

Table 5 Messaging

Enhancement	Type
Digital pen	SU-27W
Wireless keyboard	SU-8W

Table 6 Music

Enhancement	Type
Mini speakers	MD-4

Table 7 Power

Enhancement	Type
Battery Li-Ion 890 mAh	BL-5B
Travel charger	AC-3
	AC-4
	AC-5
Charger adapter	CA-44

Technical specifications

Transceiver general specifications

Unit	Dimensions (L x W x T) (mm)	Weight (g)	Volume (cm3)
Transceiver with BL-5B 890 mAh Li-Ion battery back	105 x 46 x 15	89	66

Main RF characteristics for GSM850/900/1800/1900 and WCDMA V (850) and WCDMA I (2100) phones

Parameter	Unit
Cellular system	GSM850, EGSM900, GSM1800/1900, WCDMA V (850) and WCDMA I (2100)

Parameter	Unit
Rx frequency band	GSM850: 869 - 894 MHz
	EGSM900: 925 - 960 MHz
	GSM1800: 1805 - 1880 MHz
	GSM1900: 1930 - 1990 MHz
	WCDMA V (850): 871 - 892 MHz
	WCDMA I (2100): 2110 - 2170 MHz
Tx frequency band	GSM850: 824 - 849 MHz
	EGSM900: 880 - 915 MHz
	GSM1800: 1710 - 1785 MHz
	GSM1900: 1850 - 1910 MHz
	WCDMA V (850): 826 - 847 MHz
	WCDMA I (2100): 1920 - 1980 MHz
Output power	GSM850: +5 ...+33dBm/3.2mW ... 2W
	GSM900: +5 ... +33dBm/3.2mW ... 2W
	GSM1800: +0 ... +30dBm/1.0mW ... 1W
	GSM1900: +0 ... +30dBm/1.0mW ... 1W
	WCDMA V (850): -50 ... +24 dBm/0.01μW ... 251.2mW
	WCDMA I (2100): -50 ... +24 dBm/0.01μW ... 251.2mW
Number of RF channels	GSM850: 124
	GSM900: 174
	GSM1800: 374
	GSM1900: 299
	WCDMA V (850): 108
	WCDMA I (2100): 277
Channel spacing	200 kHz
Number of Tx power levels	GSM850: 15
	GSM900: 15
	GSM1800: 16
	GSM1900: 16
	WCDMA V (850): 75
	WCDMA I (2100): 75

Battery endurance

Battery	Capacity (mAh)	Talk time	Stand-by
BL-5B	890	up to 190 min (GSM) up to 150 min (WCDMA)	up to 9 days (GSM) up to 9 days (WCDMA)

Charging times

AC-4
80 min

(This page left intentionally blank.)

2 — Service Tools and Service Concepts

(This page left intentionally blank.)

Table of Contents

Service tools 2–5
  Product specific tools 2–5
    FS-63 2–5
    MJ-135 2–5
    RJ-176 2–5
    SA-134 2–6
  General tools 2–6
    CU-4 2–7
    FLS-5 2–8
    FPS-10 2–8
    JXS-1 2–8
    PK-1 2–9
    PKD-1 2–9
    RJ-157 2–9
    RJ-160 2–9
    RJ-169 2–10
    RJ-73 2–10
    RJ-93 2–10
    SB-6 2–10
    SPS-1 2–10
    SPS-2 2–11
    SRT-6 2–11
    SS-102 2–11
    SS-46 2–11
    SS-62 2–11
    SS-93 2–12
    ST-29 2–12
    ST-40 2–12
    ST-55 2–12
    ST-59 2–12
    SX-4 2–12
  Cables 2–13
    CA-31D 2–13
    CA-35S 2–13
    CA-58RS 2–13
    DAU-9S 2–14
    DKE-2 2–14
    PCS-1 2–14
    XCS-4 2–14
    XRS-6 2–15
Service concepts 2–15
  POS (Point of Sale) flash concept 2–15
  Flash concept with FPS-10 2–16
  CU-4 flash concept with FPS-10 2–17
  Module jig service concept 2–18
  RF testing concept with RF coupler 2–19
  Service concept for RF testing and RF/BB tuning 2–20

List of Tables

Table 8 Attenuation values 2–13

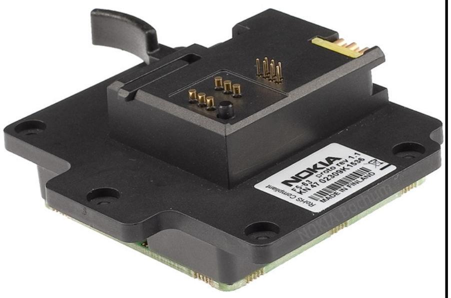
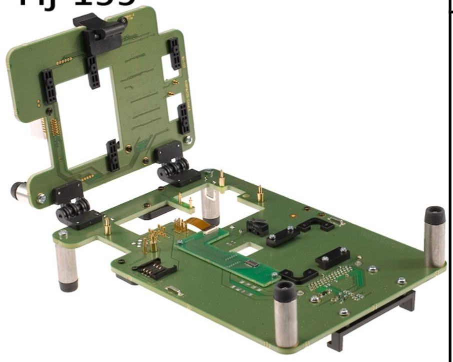
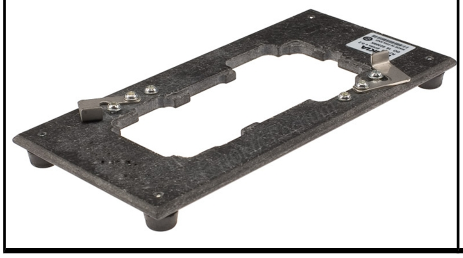
List of Figures

Figure 2 POS flash concept 2–15
Figure 3 Basic flash concept with FPS-10 2–16
Figure 4 CU-4 flash concept with FPS-10 2–17
Figure 5 Module jig service concept 2–18
Figure 6 RF testing concept with RF coupler 2–19
Figure 7 Service concept for RF testing and RF/BB tuning 2–20

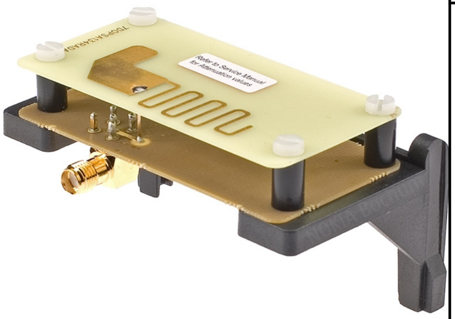
Service tools

Product specific tools

The table below gives a short overview of service tools that can be used for testing, error analysis and repair of product RM-243, refer to various concepts.

FS-63 	FS-63	Flash adapter	
	For flashing (also dead phones) with SS-46. RF testing and tuning, and EM calibration on ATO level with SS-62 (mechanical locking concept), CU-4 supported.		
MJ-135 	MJ-135	Module jig	
	MJ-135 is meant for troubleshooting, testing, tuning and flashing on the engine level (CU-4 supported). The jig includes an RF interface for GSM, WCDMA and Bluetooth.		
RJ-176 	RJ-176	Soldering jig	
	RJ-176 is a soldering jig used for soldering and as a rework jig for the engine module.		

SA-134



SA-134	RF coupler	

SA-134 is an RF coupler for WCDMA and GSM RF testing. It is used together with the product-specific flash adapter.

The following table shows attenuations from the antenna pads of the mobile terminal to the SMA connectors of SA-134 . The setup used for measuring the values is SA-134 + FS-63 + CU-4.

- **Attenuation values for inductive RF coupler SA-134**

Band	Channel	Attenuation TX	Attenuation RX
GSM 850	128	3.7	2.8
	190	3.4	2.3
	251	3.2	2.3
GSM 900	975	3.4	4.3
	37	3.4	1.8
	124	3.6	3.8
GSM 1800	512	9.5	13.7
	700	8	10.7
	885	7.3	10
GSM 1900	512	10.8	9.7
	661	9.6	9.7
	810	9.4	9.7
WCDMA Band I	9612	9.77	
	9750	10.35	
	9888	9.43	
	10562		12.2
	10700		10.7
	10838		12.4
WCDMA Band V	4132	3.35	
	4183	4.1	
	4233	3.4	
	4357		1.44
	4408		1.7
	4458		1.6

General tools

The table below gives a short overview of service tools that can be used for testing, error analysis and repair of product RM-243, refer to various concepts.

CU-4	Control unit	

CU-4 is a general service tool used with a module jig and/or a flash adapter. It requires an external 12 V power supply.

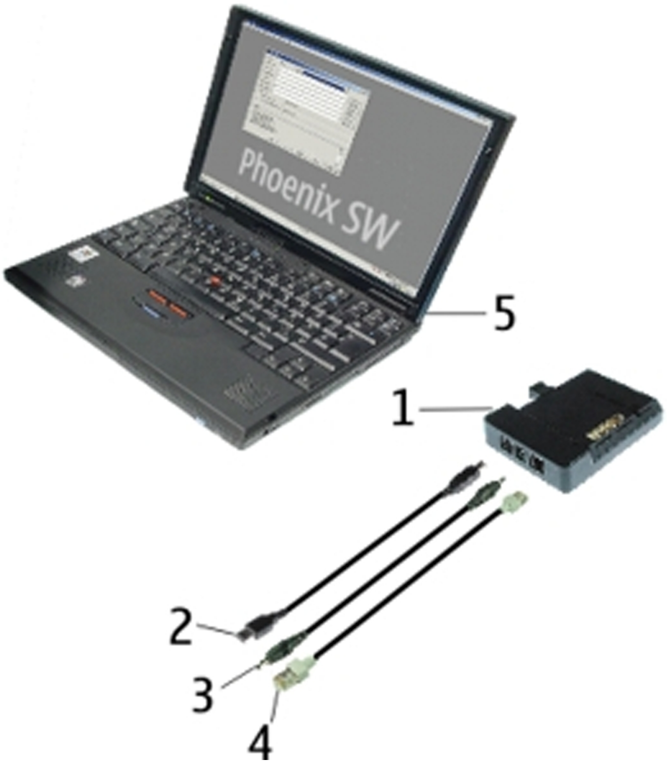
The unit has the following features:

- software controlled via USB
- EM calibration function
- Forwards FBUS/Flashbus traffic to/from terminal
- Forwards USB traffic to/from terminal
- software controlled BSI values
- regulated VBATT voltage
- 2 x USB2.0 connector (Hub)
- FBUS and USB connections supported

When using CU-4, note the special order of connecting cables and other service equipment:

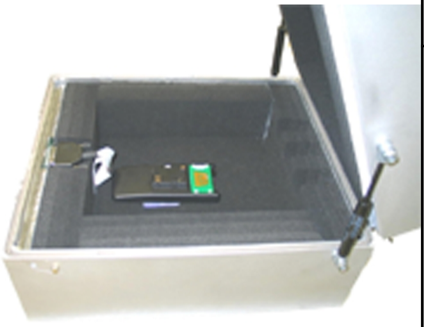
Instructions

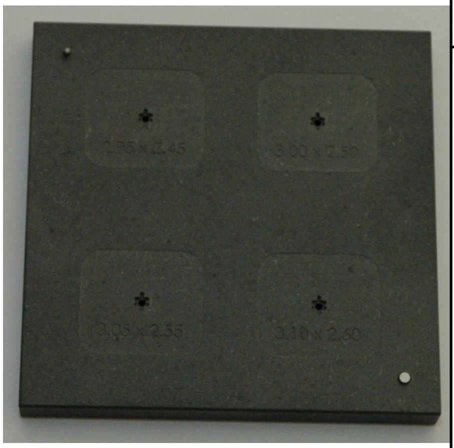
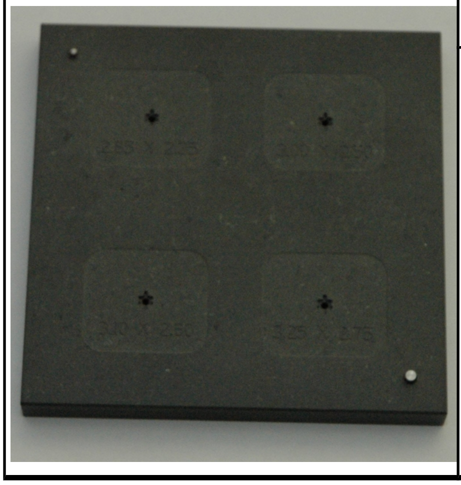
1 Connect a service tool (jig, flash adapter) to CU-4.
2 Connect CU-4 to your PC with a USB cable.
3 Connect supply voltage (12 V)
4 Connect an FBUS cable (if necessary).
5 Start Phoenix service software.

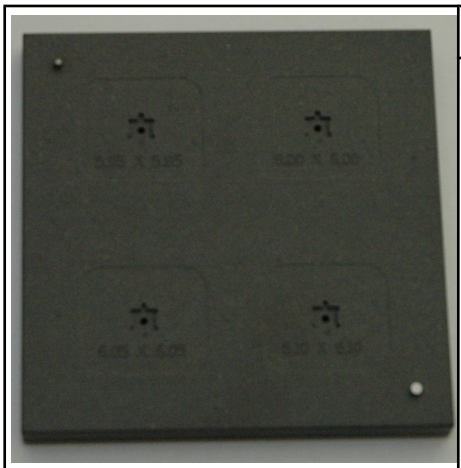
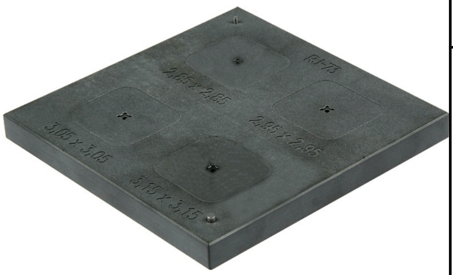


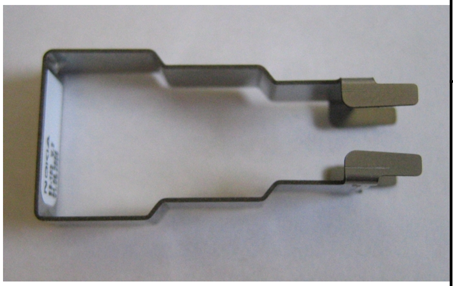
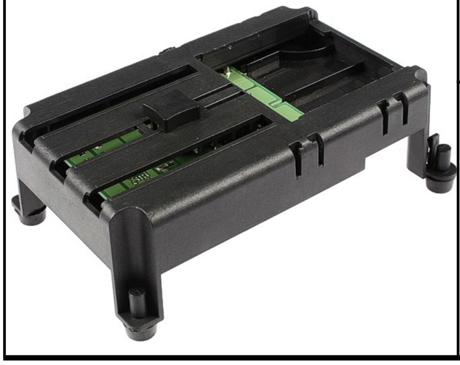
Note: Phoenix enables CU-4 regulators via USB when it is started.

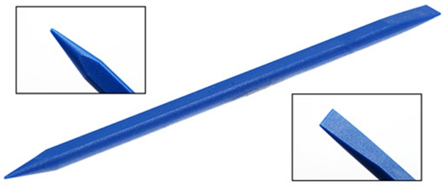
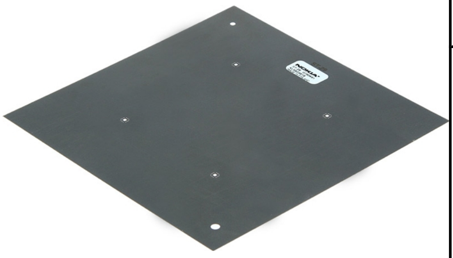
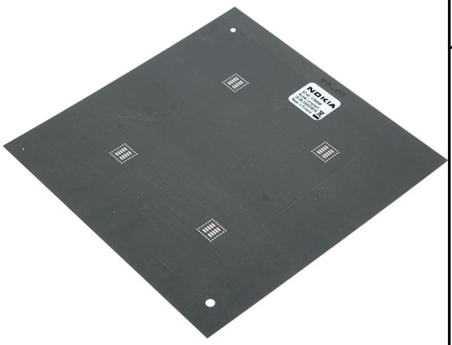
Reconnecting the power supply requires a Phoenix restart.

	FLS-5	Flash device	
	FLS-5 is a dongle and flash device incorporated into one package, developed specifically for POS use.		
	FPS-10	Flash prommer	
	FPS-10 interfaces with: • PC • Control unit • Flash adapter • Smart card FPS-10 flash prommer features: • Flash functionality for BB5 and DCT-4 terminals • Smart Card reader for SX-2 or SX-4 • USB traffic forwarding • USB to FBUS/Flashbus conversion • LAN to FBUS/Flashbus and USB conversion • Vusb output switchable by PC command FPS-10 sales package includes: • FPS-10 prommer • Power Supply with 5 country specific cords • USB cable		
	JXS-1	RF shield box	
	Because the WCDMA network disturbs the RX side testing of the WCDMA phone and the Tx signal of the WCDMA phone can severely disturb the WCDMA network, a shield box is needed in all testing, tuning and fault finding which requires WCDMA RF signal. The shield box is not an active device, it contains only passive filtering components for RF attenuation.		

<table>
<tr><td rowspan="2"> </td><td>PK-1</td><td>Software protection key</td><td></td></tr>
<tr><td colspan="3">PK-1 is a hardware protection key with a USB interface. It has the same functionality as the PKD-1 series dongle.
PK-1 is meant for use with a PC that does not have a series interface.
To use this USB dongle for security service functions please register the dongle in the same way as the PKD-1 series dongle.</td></tr>
<tr><td rowspan="2"> </td><td>PKD-1</td><td>SW security device</td><td></td></tr>
<tr><td colspan="3">SW security device is a piece of hardware enabling the use of the service software when connected to the parallel (LPT) port of the PC.
Without the device, it is not possible to use the service software.
Printer or any such device can be connected to the PC through the device if needed.</td></tr>
<tr><td rowspan="2"></td><td>RJ-157</td><td>Rework jig</td><td></td></tr>
<tr><td colspan="3">RJ-157 is a rework jig used when servicing the Z7540 duplexer. It is used together with the ST-55 stencil.</td></tr>
<tr><td rowspan="2"></td><td>RJ-160</td><td>Rework jig</td><td></td></tr>
<tr><td colspan="3">RJ-160 is a rework jig used when servicing the WCDMA duplexer (Z7541). It is used together with the ST-55 stencil.</td></tr>
</table>

	RJ-169	Rework jig	
	RJ-169 is a rework jig used when servicing the WCDMA PA (N7540) component. It is used together with the ST-59 stencil.		
	RJ-73	Rework jig	
	RJ-73 is a rework jig used when servicing the N7601 component. It is used together with the ST-29 rework stencil.		
	RJ-93	Rework jig	
	RJ-93 is used as a rework jig for the Front End Module (FEM). This rework jig takes the FEM or power amplifier (PA) module (N7520) for spreading the soldering paste to the component. Must be used together with the ST-40 stencil.		
NOKIA RF-I/O CLASS 1 STATUS BER TEST FBUS POWER	SB-6	Bluetooth test and interface box (sales package)	
	The SB-6 test box is a generic service device used to perform Bluetooth bit error rate (BER) testing, and establishing cordless FBUS connection via Bluetooth. An ACP-8x charger is needed for BER testing and an AXS-4 cable in case of cordless interface usage testing . Sales package includes: • SB-6 test box • Installation and warranty information		
	SPS-1	Soldering Paste Spreader	

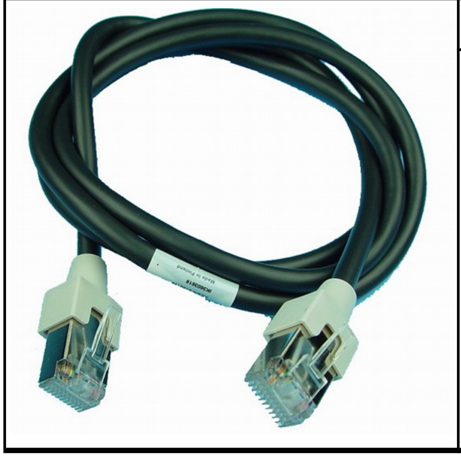
	SPS-2	Soldering paste spreader	
	SRT-6	Opening tool	
	SRT-6 is used to open phone covers.		
	SS-102	Front camera removal tool	
	The front camera removal tool SS-102 is used to remove/attach a front camera module from/to the camera socket of the phone PWB.		
	SS-46	Interface adapter	
	SS-46 acts as an interface adapter between the flash adapter and FPS-10.		
	SS-62	Generic flash adapter base for BB5	
	• generic base for flash adapters and couplers • SS-62 equipped with a clip interlock system • provides standardised interface towards Control Unit • provides RF connection using galvanic connector or coupler • multiplexing between USB and FBUS media, controlled by VUSB		

	SS-93	Opening tool	SS-93 is used for opening JAE connectors.
	ST-29	rework stencil	ST-29 is a rework stencil used when servicing the N7601 component. It is used together with rework jig RJ-73.
	ST-40	Rework stencil	ST-40 is a rework stencil that is used with the RJ-93 rework jig to service the Front End Module (N7520).
	ST-55	Rework stencil	ST-55 is a rework stencil used when servicing the Z7540 and Z7541 duplexers. It is used together with the rework jigs RJ-157 and RJ-160.
	ST-59	Rework stencil	ST-59 is a rework stencil used when servicing the WCDMA PA (N7540) component. It is used together with rework jig RJ-169.
	SX-4	Smart card	SX-4 is a BB5 security device used to protect critical features in tuning and testing. SX-4 is also needed together with FPS-10 when DCT-4 phones are flashed.

Cables

The table below gives a short overview of service tools that can be used for testing, error analysis and repair of product RM-243, refer to various concepts.

<table>
<tr><td rowspan="2"> </td><td>CA-31D</td><td>USB cable</td><td></td></tr>
<tr><td colspan="3">The CA-31D USB cable is used to connect FPS-10 or FPS-11 to a PC. It is included in the FPS-10 and FPS-11 sales packages.</td></tr>
<tr><td rowspan="2"> </td><td>CA-35S</td><td>Power cable</td><td></td></tr>
<tr><td colspan="3">CA-35S is a power cable for connecting, for example, the FPS-10 flash prommer to the Point-Of-Sales (POS) flash adapter.</td></tr>
<tr><td rowspan="2"> </td><td>CA-58RS</td><td>RF tuning cable</td><td></td></tr>
<tr><td colspan="3">Product-specific adapter cable for RF tuning.
• **Table 8 Attenuation values**
<table>
<tr><th>Band</th><th>Attenuation Rx/Tx</th></tr>
<tr><td>GSM850/900</td><td>0.2...0.3 dB</td></tr>
<tr><td>GSM1800/1900</td><td>0.3...0.4 dB</td></tr>
<tr><td>WCDMA850</td><td>0.2...0.3 dB</td></tr>
<tr><td>WCDMA2100</td><td>0.4...0.6 dB</td></tr>
</table></td></tr>
</table>

<table>
<tr><td rowspan="2"> </td><td>DAU-9S</td><td>MBUS cable</td><td></td></tr>
<tr><td colspan="3">The MBUS cable DAU-9S has a modular connector and is used, for example, between the PC's serial port and module jigs, flash adapters or docking station adapters.
Note: Docking station adapters valid for DCT4 products.</td></tr>
<tr><td rowspan="2"> </td><td>DKE-2</td><td>Mini-USB cable</td><td></td></tr>
<tr><td colspan="3">USB to mini-USB connector cable.</td></tr>
<tr><td rowspan="2"> </td><td>PCS-1</td><td>Power cable</td><td></td></tr>
<tr><td colspan="3">The PCS-1 power cable (DC) is used with a docking station, a module jig or a control unit to supply a controlled voltage.</td></tr>
<tr><td rowspan="2"></td><td>XCS-4</td><td>Modular cable</td><td></td></tr>
<tr><td colspan="3">XCS-4 is a shielded (one specially shielded conductor) modular cable for flashing and service purposes.</td></tr>
</table>

	XRS-6	RF cable	
	The RF cable is used to connect, for example, a module repair jig to the RF measurement equipment. SMA to N-Connector approximately 610 mm. Attenuation for: • GSM850/900: 0.3+-0.1 dB • GSM1800/1900: 0.5+-0.1 dB • WCDMA850: 0.3+-0.1 dB • WCDMA2100: 0.6+-0.1dB		

Service concepts

POS (Point of Sale) flash concept

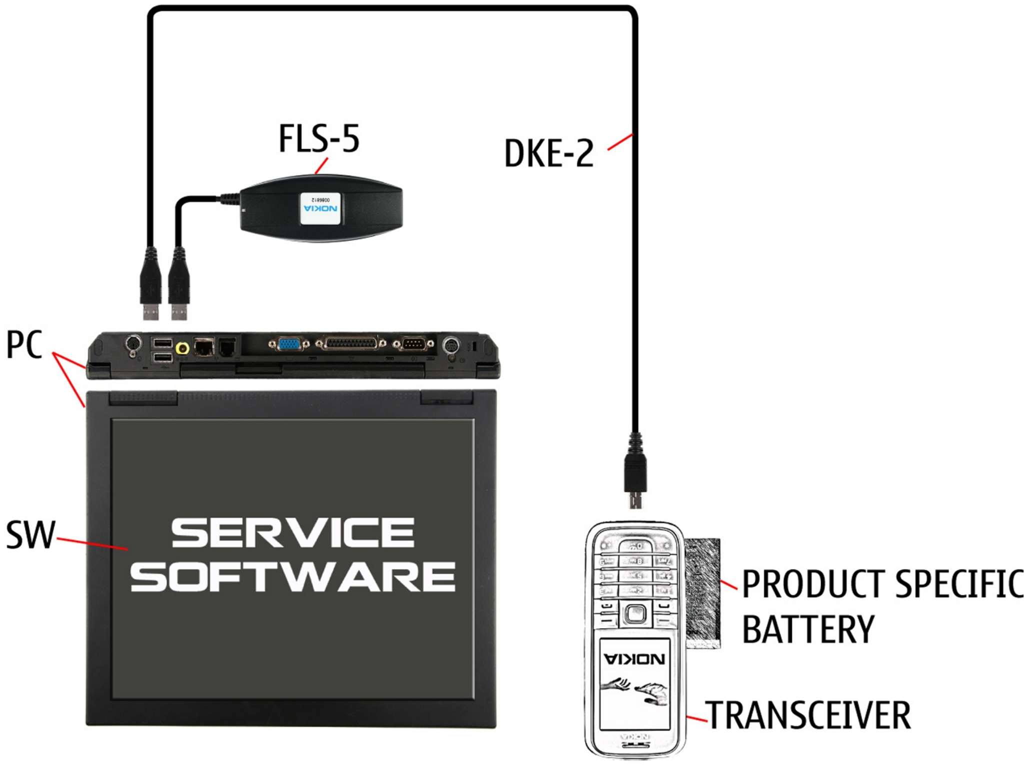

FLS-5
DKE-2
PC
SW
SERVICE SOFTWARE
PRODUCT SPECIFIC BATTERY
TRANSCEIVER

Figure 2 POS flash concept

Type	Description
Product specific tools	
BL-5B	Battery
Other tools	
FLS-5	POS flash dongle
	PC with Phoenix service software
Cables	

Type	Description
DKE-2	USB connectivity cable

Flash concept with FPS-10

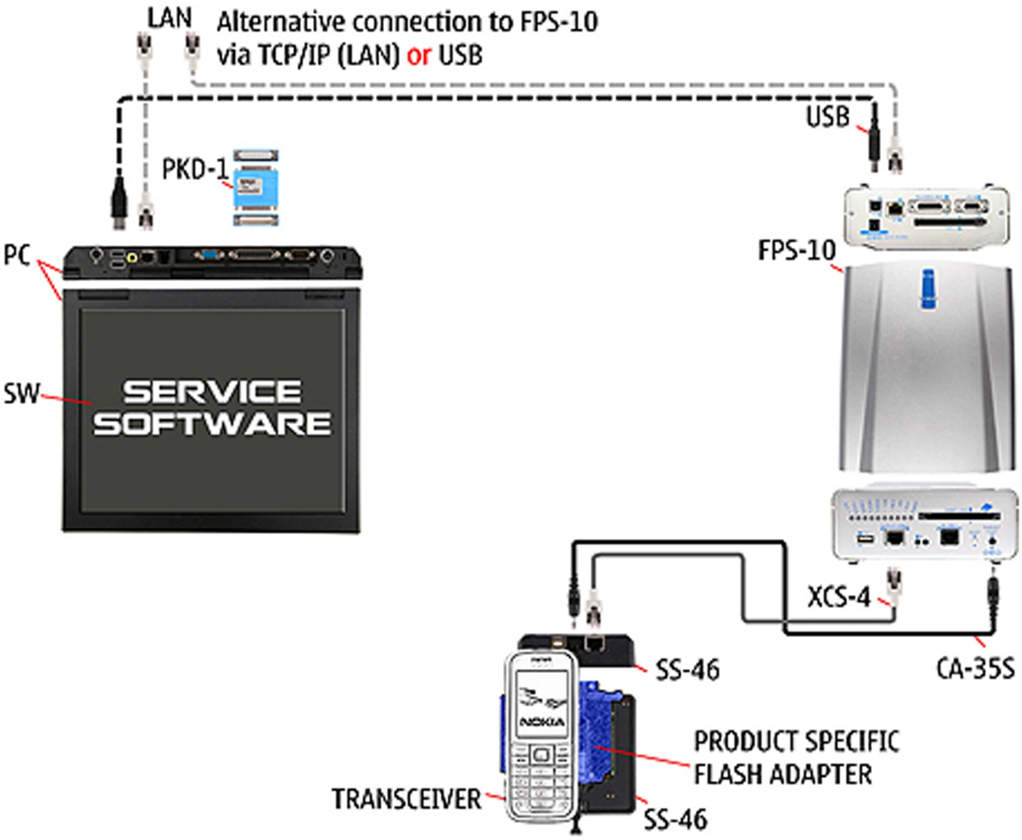

LAN
Alternative connection to FPS-10 via TCP/IP (LAN) or USB
USB
PKD-1
PC
FPS-10
SW
SERVICE SOFTWARE
XCS-4
SS-46
CA-35S
PRODUCT SPECIFIC FLASH ADAPTER
TRANSCEIVER
SS-46

Figure 3 Basic flash concept with FPS-10

Type	Description
Product specific devices	
FS-63	Flash adapter
Other devices	
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-46	Interface adapter
	PC with Phoenix service software
Cables	
XCS-4	Modular cable
CA-35S	Power cable
	USB cable

CU-4 flash concept with FPS-10

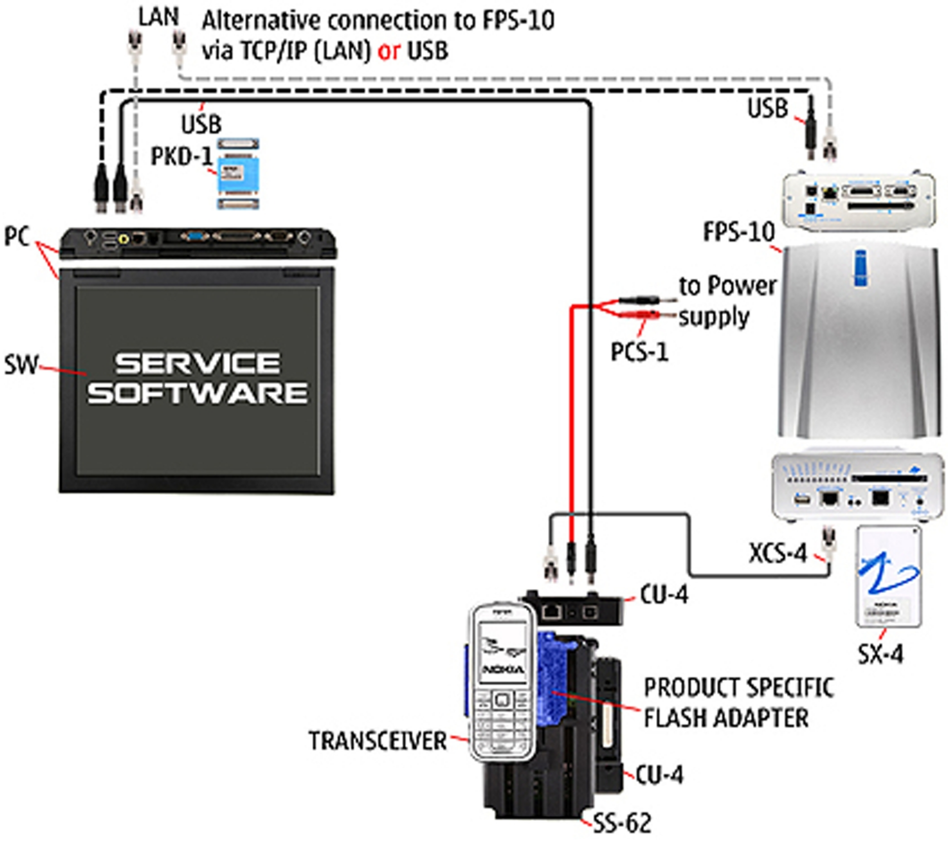

LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
USB
PKD-1
USB
PC
FPS-10
to Power
supply
PCS-1
SW
SERVICE
SOFTWARE
XCS-4
CU-4
SX-4
PRODUCT SPECIFIC
FLASH ADAPTER
TRANSCEIVER
CU-4
SS-62

Figure 4 CU-4 flash concept with FPS-10

Type	Description
Product specific devices	
FS-63	Flash adapter
Other devices	
CU-4	Control unit
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
SX-4	Smart card
	PC with Phoenix service software
Cables	
PCS-1	Power cable
XCS-4	Modular cable
	Standard USB cable
	USB cable

Module jig service concept

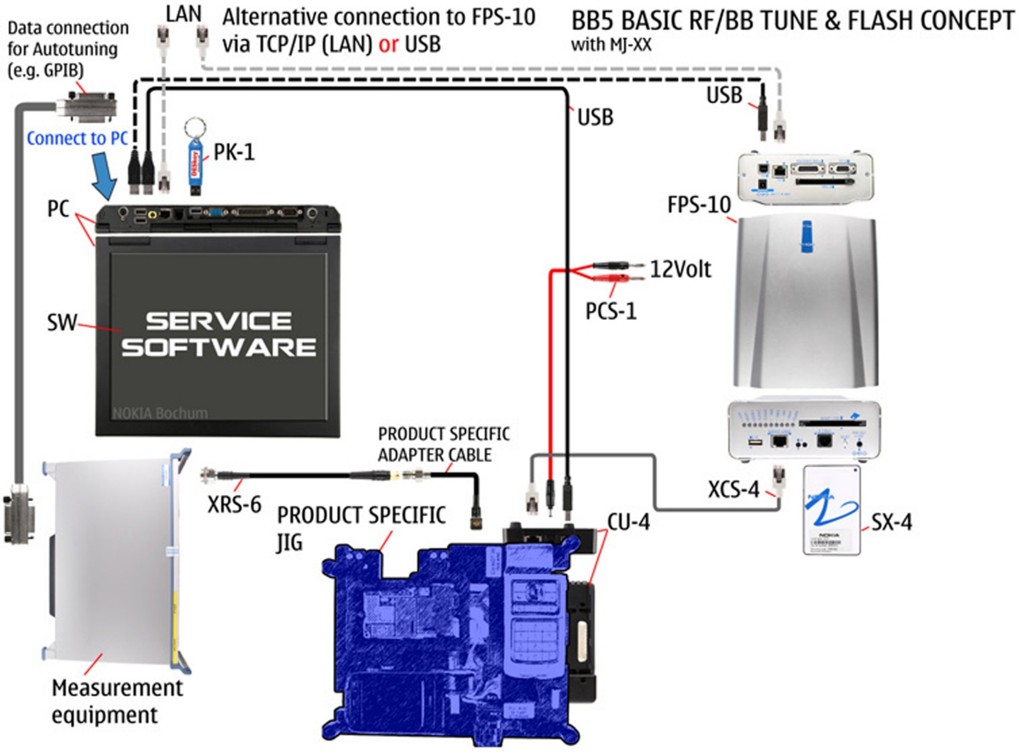

Data connection
for Autotuning
(e.g. GPIB)
LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
BB5 BASIC RF/BB TUNE & FLASH CONCEPT
with MJ-XX
USB
USB
Connect to PC
PK-1
PC
FPS-10
12Volt
PCS-1
SW
SERVICE
SOFTWARE
NOKIA Bochum
PRODUCT SPECIFIC
ADAPTER CABLE
XRS-6
PRODUCT SPECIFIC
JIG
CU-4
XCS-4
SX-4
Measurement
equipment

Figure 5 Module jig service concept

Type	Description
Phone specific tools	
MJ-135	Module jig
Other tools	
CU-4	Control unit
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SX-4	Smart card
	PC with Phoenix service software
	Measurement equipment
Cables	
CA-58RS	RF service cable (product-specific adapter cable)
PCS-1	DC power cable
XCS-4	Modular cable
XRS-6	RF cable
	USB cable
	GPIB control cable

RF testing concept with RF coupler

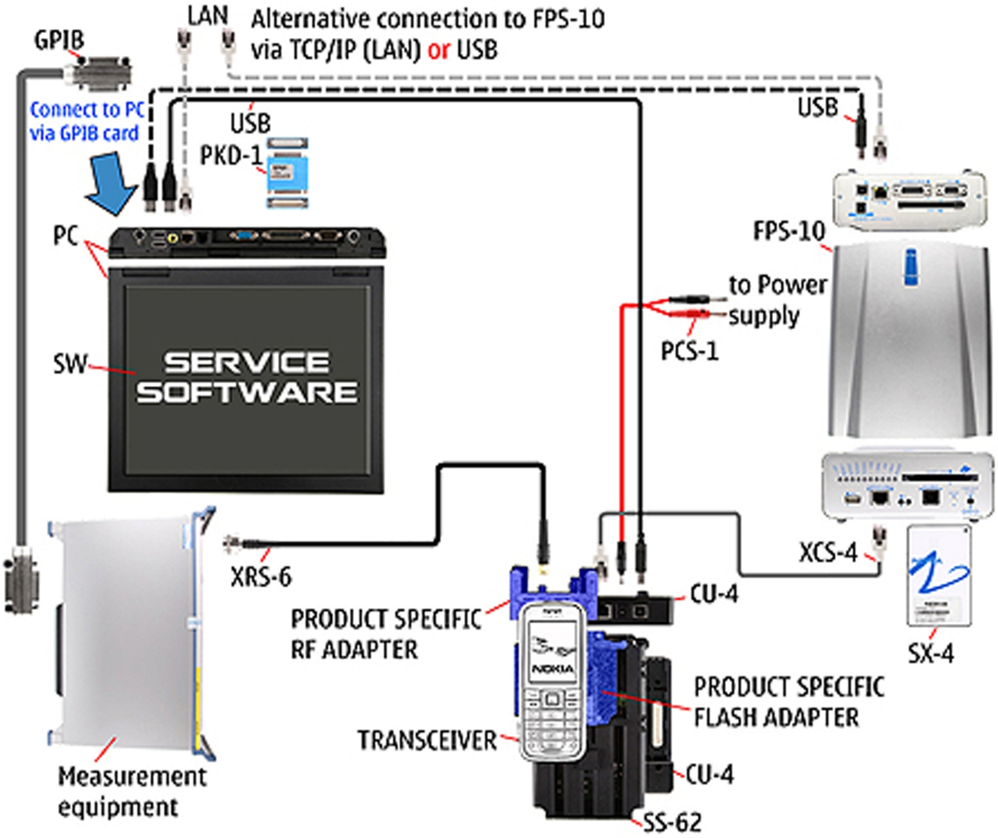

GPIB
LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
Connect to PC
via GPIB card
USB
PKD-1
USB
PC
FPS-10
to Power
supply
PCS-1
SW
SERVICE
SOFTWARE
XRS-6
XCS-4
PRODUCT SPECIFIC
RF ADAPTER
CU-4
SX-4
PRODUCT SPECIFIC
FLASH ADAPTER
TRANSCEIVER
CU-4
Measurement
equipment
SS-62

Figure 6 RF testing concept with RF coupler

Type	Description
Product specific devices	
FS-63	Flash adapter
SA-134	RF coupler
Other devices	
CU-4	Control unit
SX-4	Smart card
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
	Measurement equipment
	PC with Phoenix service software
Cables	
PCS-1	Power cable
XCS-4	Modular cable
XRS-6	RF cable

Type	Description
	GPIB control cable
	USB cable

Service concept for RF testing and RF/BB tuning

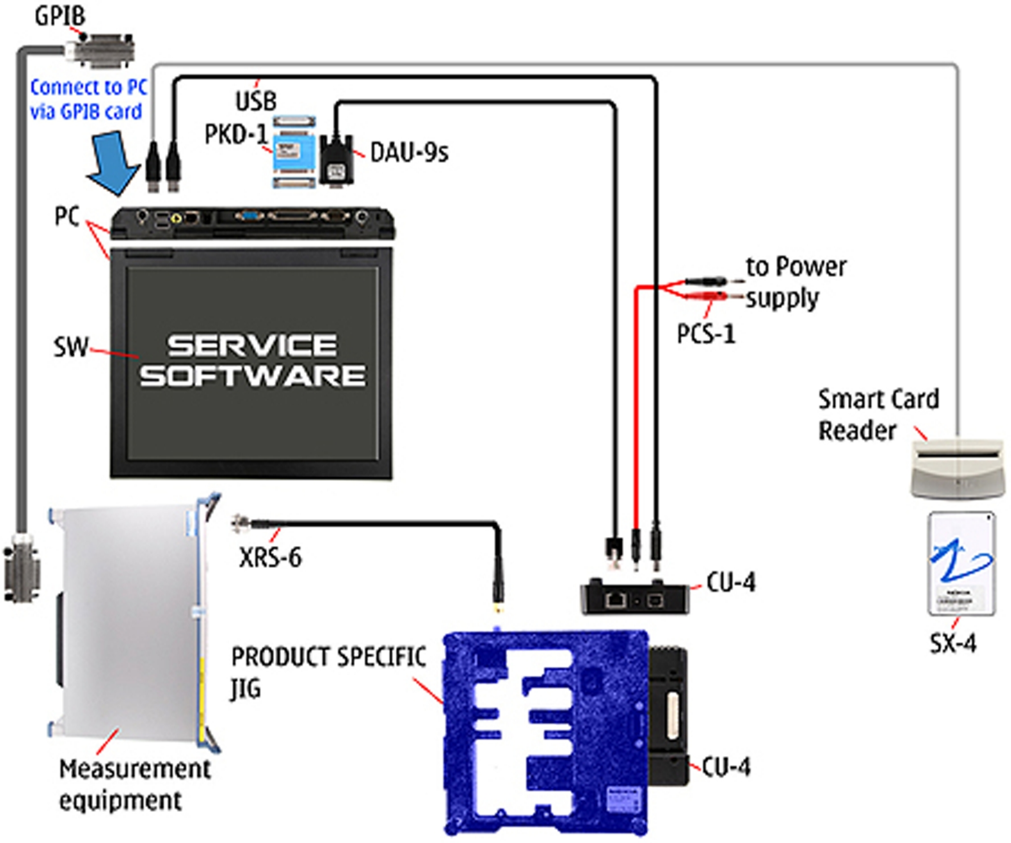

GPIB
Connect to PC via GPIB card
USB
PKD-1
DAU-9s
PC
SW
SERVICE SOFTWARE
to Power supply
PCS-1
Smart Card Reader
XRS-6
CU-4
SX-4
PRODUCT SPECIFIC JIG
Measurement equipment
CU-4

Figure 7 Service concept for RF testing and RF/BB tuning

Type	Description
Product specific devices	
MJ-135	Module jig
Other devices	
CU-4	Control unit
PKD-1/PK-1	SW security device
SX-4	Smart card
	Measurement equipment
	Smart card reader
	PC with Phoenix service software
Cables	
DAU-9s	MBUS cable

Type	Description
PCS-1	DC power cable
XRS-6	RF cable
	GPIB control cable
	USB cable

(This page left intentionally blank.)

3 — BB Troubleshooting and Manual Tuning Guide

(This page left intentionally blank.)

Table of Contents

Troubleshooting overview 3–5
Dead or jammed device troubleshooting 3–6
General power checking 3–7
Clocking troubleshooting 3–8
Charging troubleshooting 3–9
Backup battery troubleshooting 3–10
Flash programming fault troubleshooting 3–11
Combo memory troubleshooting 3–13
MicroSD card troubleshooting 3–14
USB interface troubleshooting 3–16
SIM card troubleshooting 3–17
Keyboard troubleshooting 3–19
Power key troubleshooting 3–20
Vibra troubleshooting 3–21
Display module troubleshooting 3–21
    General instructions for display troubleshooting 3–21
    Display troubleshooting 3–24
Backlights and LED driver troubleshooting 3–25
Bluetooth and FM radio 3–26
    Introduction to Bluetooth/FM Radio troubleshooting 3–26
    Bluetooth settings for Phoenix 3–28
    Bluetooth self tests in Phoenix 3–29
    Bluetooth troubleshooting 3–31
    FM radio troubleshooting 3–31
Audio troubleshooting 3–33
    Audio troubleshooting test instructions 3–33
    Internal earpiece troubleshooting 3–36
    Internal microphone troubleshooting 3–37
    IHF speakers troubleshooting 3–38
    External headset microphone troubleshooting 3–39
    External headset earpiece troubleshooting 3–40
    Acoustics troubleshooting 3–41
        Introduction to acoustics troubleshooting 3–41
        Earpiece troubleshooting 3–42
        IHF troubleshooting 3–43
        Microphone troubleshooting 3–44
Baseband manual tuning guide 3–45
    Certificate restoring 3–45
    Energy management calibration 3–46

List of Tables

Table 9 Display module troubleshooting cases 3–22
Table 10 Pixel defects 3–22
Table 11 Calibration value limits 3–46

List of Figures

Figure 8 Charging backup battery 3–10
Figure 9 Discharging backup battery 3–10

Figure 10 Take single trig measurement for the rise of the BSI signal. 3–12
Figure 11 RM-243 Bluetooth antenna 3–27
Figure 12 RM-243 Bluetooth and FM radio component layout 3–28
Figure 13 BER test result 3–29
Figure 14 Bluetooth self tests in Phoenix 3–30
Figure 15 Single-ended output waveform of the Ext_in_HP_out measurement when earpiece is connected. 3–34
Figure 16 Single-ended output waveform of the Ext_in_IHF_out out loop measurement when speaker is connected (measured at speaker pads). No filter is used. 3–35
Figure 17 Single-ended output waveform of the Ext_in_Ext_out loop. 3–35
Figure 18 Single-ended output waveform of the HP_microphone_in_Ext_out loop. 3–35

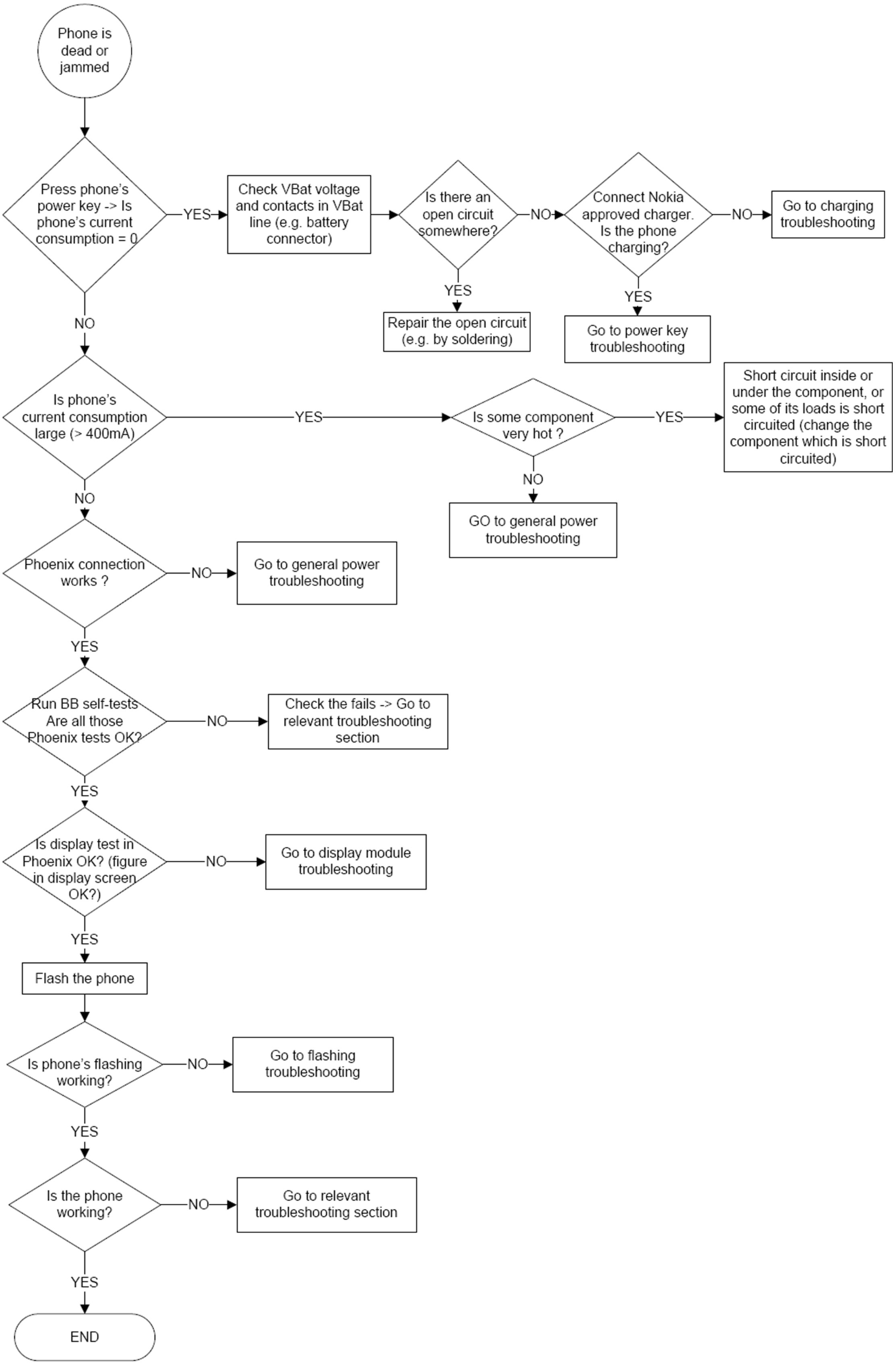
Troubleshooting overview

For practical reasons, troubleshooting is divided into two sections;

- Baseband troubleshooting, including camera, FM radio and Bluetooth.
- RF troubleshooting

Dead or jammed device troubleshooting

Troubleshooting flow


Phone is dead or jammed
Press phone's power key -> Is phone's current consumption = 0
YES
Check VBat voltage and contacts in VBat line (e.g. battery connector)
Is there an open circuit somewhere?
NO
Connect Nokia approved charger. Is the phone charging?
NO
Go to charging troubleshooting
YES
Repair the open circuit (e.g. by soldering)
YES
Go to power key troubleshooting
NO
Is phone's current consumption large (> 400mA)
YES
Is some component very hot ?
YES
Short circuit inside or under the component, or some of its loads is short circuited (change the component which is short circuited)
NO
GO to general power troubleshooting
NO
Phoenix connection works ?
NO
Go to general power troubleshooting
YES
Run BB self-tests Are all those Phoenix tests OK?
NO
Check the fails -> Go to relevant troubleshooting section
YES
Is display test in Phoenix OK? (figure in display screen OK?)
NO
Go to display module troubleshooting
YES
Flash the phone
Is phone's flashing working?
NO
Go to flashing troubleshooting
YES
Is the phone working?
NO
Go to relevant troubleshooting section
YES
END

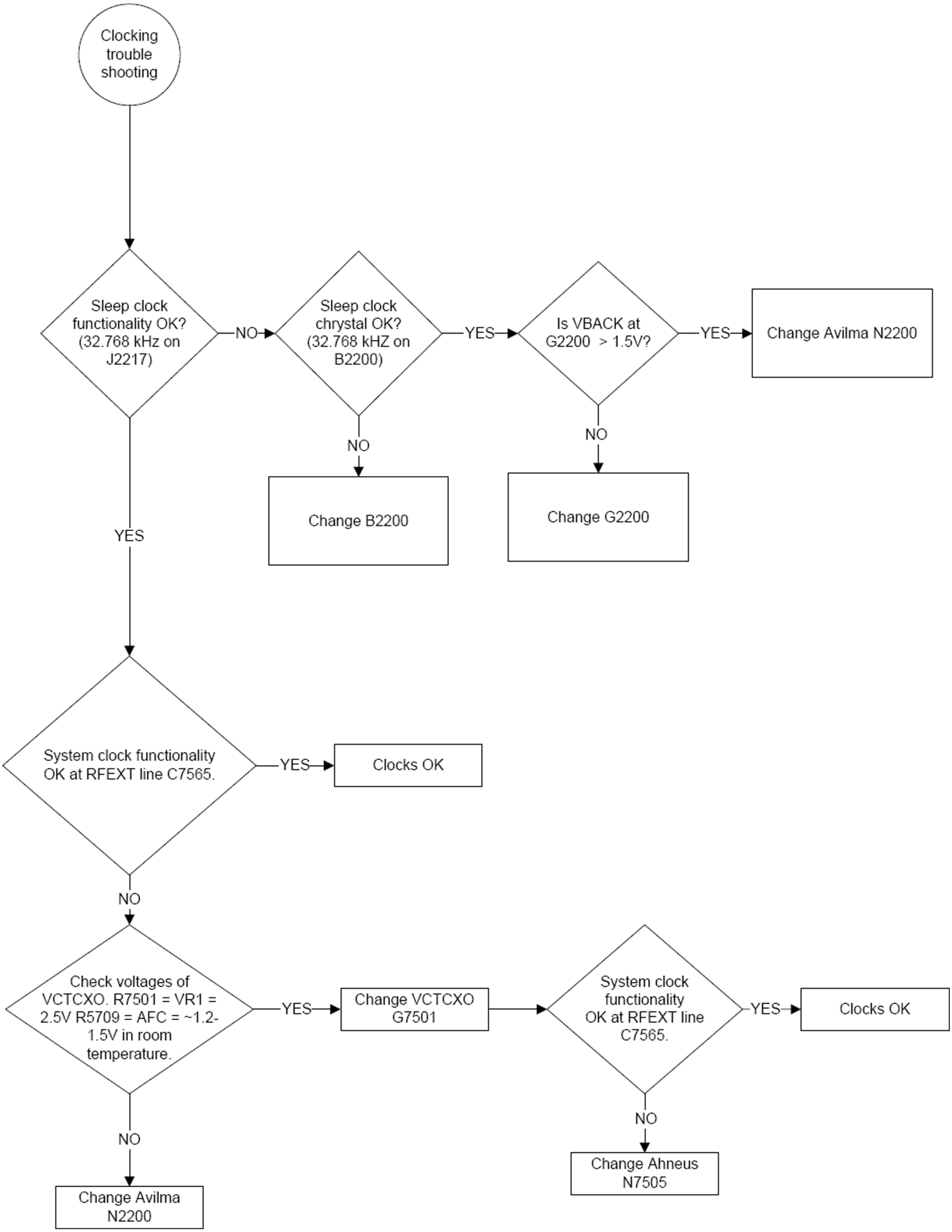
General power checking

Check the following voltages:

Signal name	Regulator	Sleep	Idle	Nominal voltage	Main user	Notes	Supply
VIO	AVILMA	ON	ON	1.82	Memory, I/Os		VBAT1
VBACK	AVILMA	ON	ON	2.5	Back-up battery		
VSIM1	AVILMA	ON	ON	1.8/3.0	SIM card		VBAT3
VSIM2	AVILMA	ON	ON		LNA amplifier		VBAT3
VDRAM	AVILMA	ON	ON	1.82	SDRAM		VBAT2
VAUX	AVILMA	OFF	OFF	2.78	Display		VBAT5
VANA	AVILMA	ON	ON	2.5	AVILMA		VBAT4
VR1	AVILMA	OFF	ON	2.5	Crystal oscillators	DC/DC converter in RF	VBAT4
VRFC	AVILMA	ON	OFF	1.8	RAPIDO converters		
VRCP1	AVILMA			4.75	To RF parts	RF active	VBATCP
VRCP2	AVILMA			4.75	To RF parts	RF active	VBATCP
VREF	AVILMA	ON	ON	1.35	RF reference		
VCORE	Barracuda	ON	ON	1.35/1.05 on sleep	RAPIDO digital core		
VOUT	BETTY	OFF	OFF	2.5		Audio switch	
VANA_CAM	External LDO			2.8	Camera		
VDIG_CAM	External SMPS			1.8	Camera		
LEDOUT	BETTY LED driver			14	Display and key LEDs		
VSD	SD levelshifter			2.85	MicroSD card		
VDDI	External LDO	ON	ON	1.8	Display		

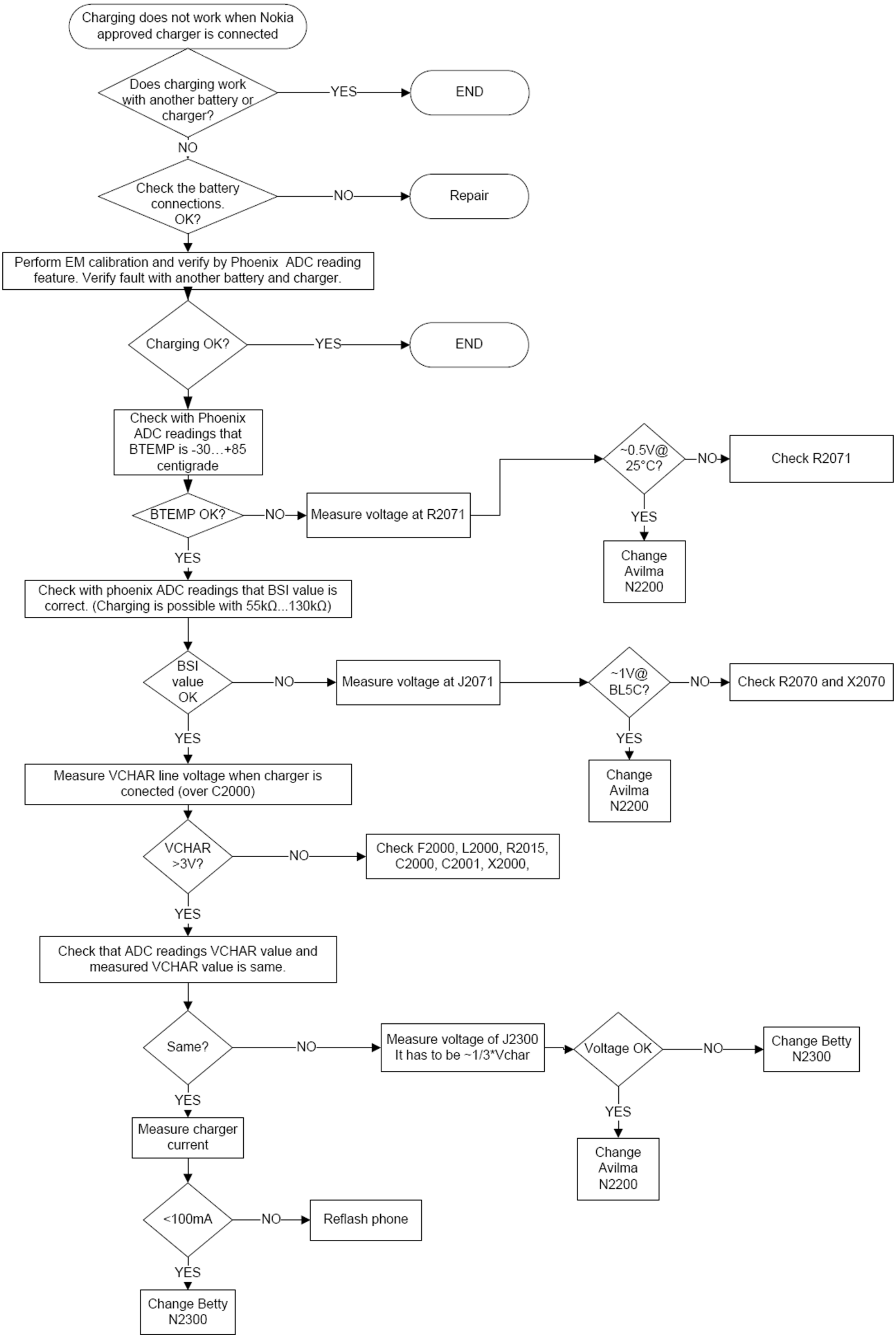
Clocking troubleshooting

Troubleshooting flow


Clocking trouble shooting
Sleep clock functionality OK? (32.768 kHz on J2217)
NO
Sleep clock chrystal OK? (32.768 kHZ on B2200)
YES
Is VBACK at G2200 > 1.5V?
YES
Change Avilma N2200
NO
Change B2200
NO
Change G2200
YES
System clock functionality OK at RFEXT line C7565.
YES
Clocks OK
NO
Check voltages of VCTCXO. R7501 = VR1 = 2.5V R5709 = AFC = ~1.2-1.5V in room temperature.
YES
Change VCTCXO G7501
System clock functionality OK at RFEXT line C7565.
YES
Clocks OK
NO
Change Ahneus N7505
NO
Change Avilma N2200

Charging troubleshooting

Troubleshooting flow


Charging does not work when Nokia approved charger is connected
Does charging work with another battery or charger?
YES
END
NO
Check the battery connections. OK?
NO
Repair
Perform EM calibration and verify by Phoenix ADC reading feature. Verify fault with another battery and charger.
Charging OK?
YES
END
Check with Phoenix ADC readings that BTEMP is -30…+85 centigrade
BTEMP OK?
NO
Measure voltage at R2071
~0.5V@ 25°C?
NO
Check R2071
YES
Change Avilma N2200
YES
Check with phoenix ADC readings that BSI value is correct. (Charging is possible with 55kΩ...130kΩ)
BSI value OK
NO
Measure voltage at J2071
~1V@ BL5C?
NO
Check R2070 and X2070
YES
Change Avilma N2200
YES
Measure VCHAR line voltage when charger is conected (over C2000)
VCHAR >3V?
NO
Check F2000, L2000, R2015, C2000, C2001, X2000,
YES
Check that ADC readings VCHAR value and measured VCHAR value is same.
Same?
NO
Measure voltage of J2300 It has to be ~1/3*Vchar
Voltage OK
NO
Change Betty N2300
YES
Change Avilma N2200
YES
Measure charger current
<100mA
NO
Reflash phone
YES
Change Betty N2300

Backup battery troubleshooting

Verify that the backup battery is empty (U<1V). Switch the phone on. Measure voltage of the battery when the main battery is connected to the phone and the phone is switched on.

Wait a few minutes and monitor that the backup battery voltage rises. Switch off the phone, disconnect the main battery and monitor that the voltage of the backup battery decreases. Normal behaviour of the voltage is described in the figures below.

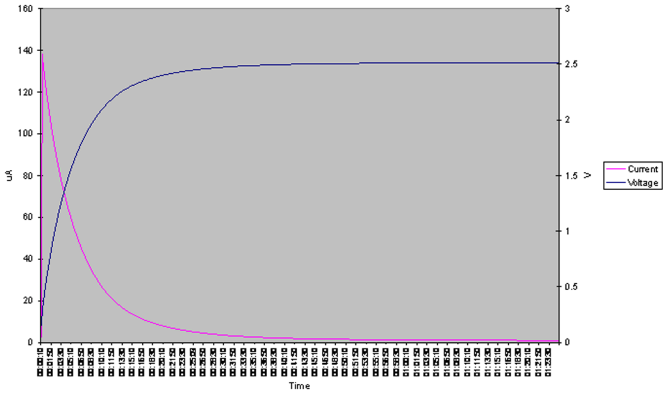


Figure 8 Charging backup battery

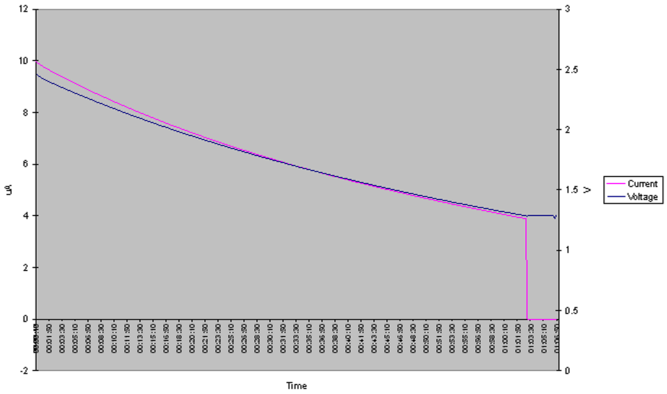
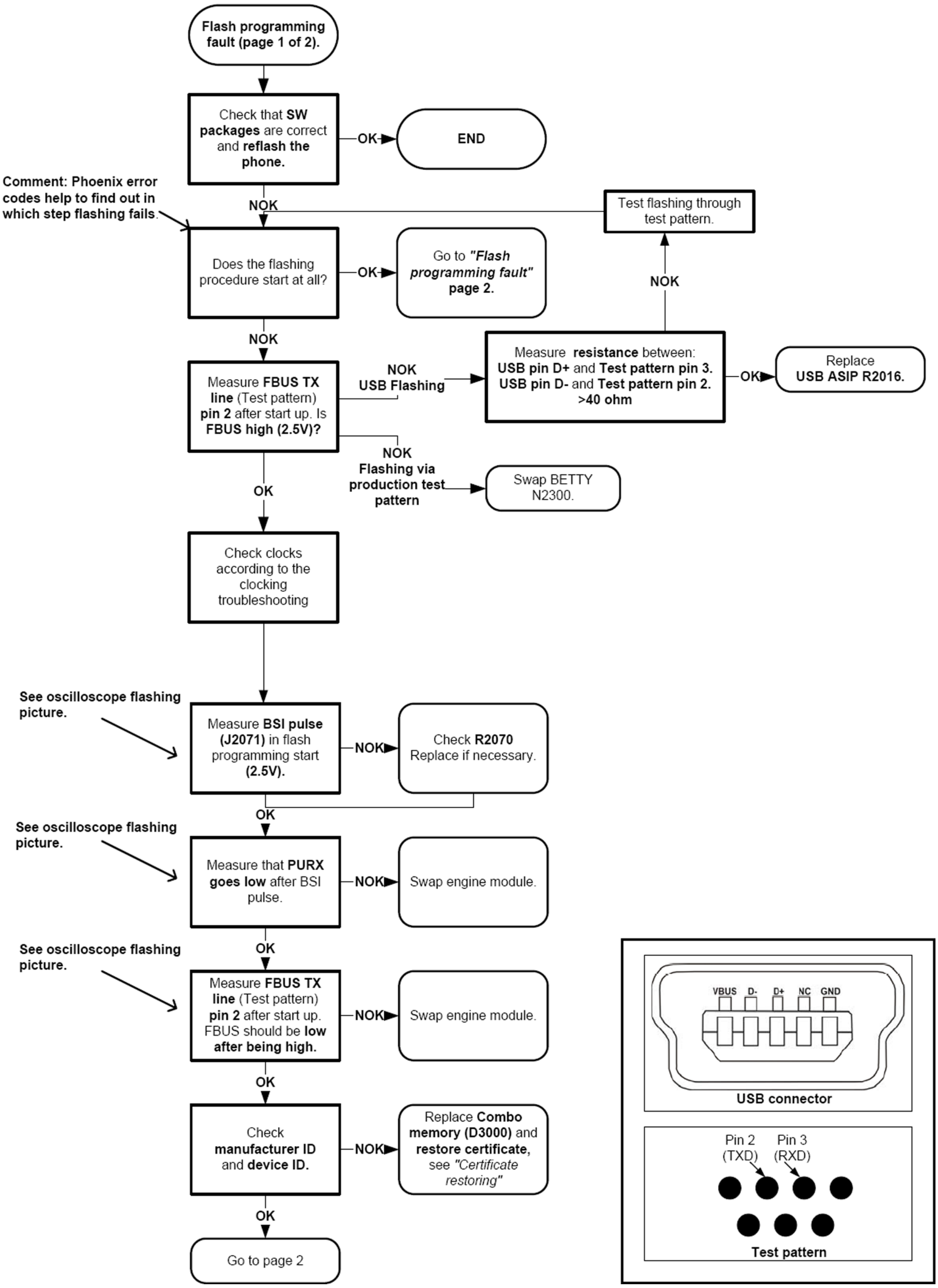


Figure 9 Discharging backup battery

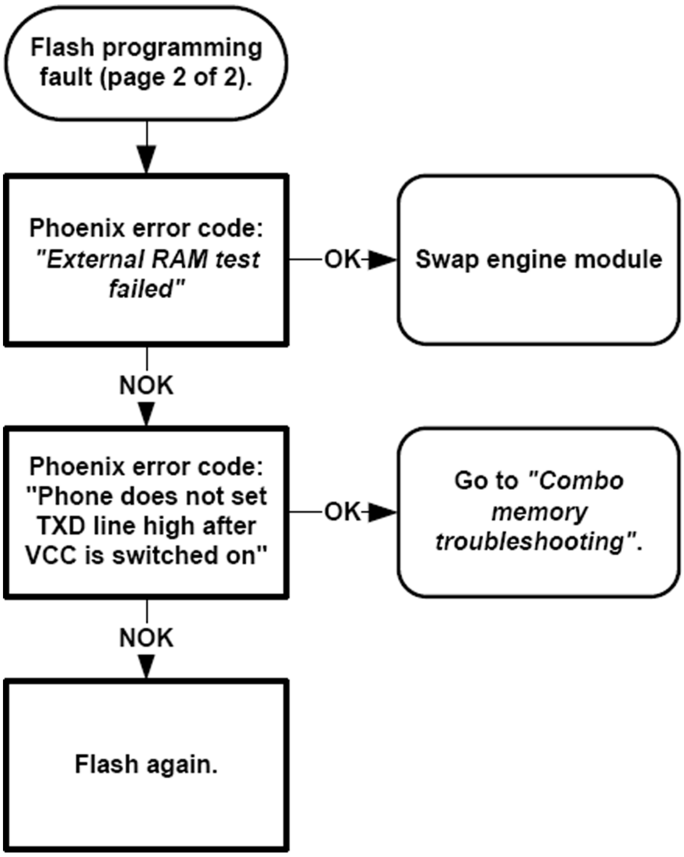
If the voltage rises and falls quickly, check whether G2200 or C2242 is broken or short-circuited. Backup battery can be also dead. If the voltage stays ~0V, check resistance VBACK against GND. If there is no short-circuit, AVILMA is faulty. Replace AVILMA.

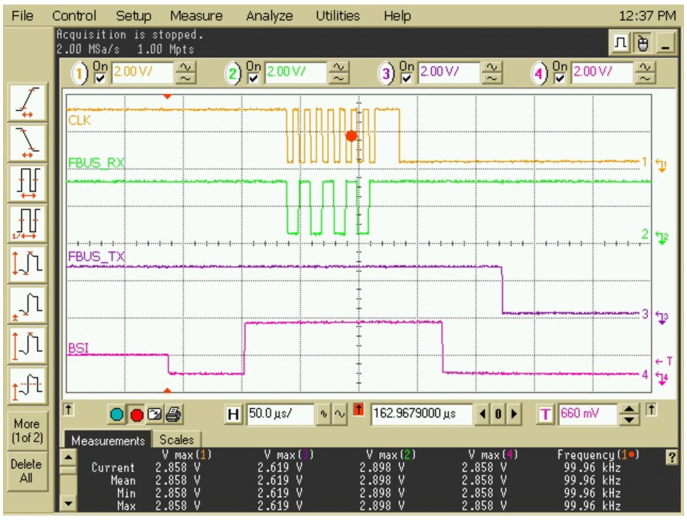
Flash programming fault troubleshooting

Part 1


Flash programming fault (page 1 of 2).
Check that SW packages are correct and reflash the phone.
OK
END
NOK
Comment: Phoenix error codes help to find out in which step flashing fails.
Test flashing through test pattern.
Does the flashing procedure start at all?
OK
Go to "Flash programming fault" page 2.
NOK
NOK
Measure FBUS TX line (Test pattern) pin 2 after start up. Is FBUS high (2.5V)?
NOK USB Flashing
Measure resistance between: USB pin D+ and Test pattern pin 3. USB pin D- and Test pattern pin 2. >40 ohm
OK
Replace USB ASIP R2016.
NOK Flashing via production test pattern
Swap BETTY N2300.
OK
Check clocks according to the clocking troubleshooting
See oscilloscope flashing picture.
Measure BSI pulse (J2071) in flash programming start (2.5V).
NOK
Check R2070 Replace if necessary.
OK
See oscilloscope flashing picture.
Measure that PURX goes low after BSI pulse.
NOK
Swap engine module.
OK
See oscilloscope flashing picture.
Measure FBUS TX line (Test pattern) pin 2 after start up. FBUS should be low after being high.
NOK
Swap engine module.
OK
Check manufacturer ID and device ID.
NOK
Replace Combo memory (D3000) and restore certificate, see "Certificate restoring"
OK
Go to page 2
VBUS
D-
D+
NC
GND
USB connector
Pin 2 (TXD)
Pin 3 (RXD)
Test pattern

Part 2


Flash programming fault (page 2 of 2).
Phoenix error code: *"External RAM test failed"*
OK
Swap engine module
NOK
Phoenix error code: "Phone does not set TXD line high after VCC is switched on"
OK
Go to *"Combo memory troubleshooting"*.
NOK
Flash again.


File
Control
Setup
Measure
Analyze
Utilities
Help
12:37 PM
On 2.00 V/
On 2.00 V/
On 2.00 V/
On 2.00 V/
CLK
FBUS_RX
FBUS_TX
BSI
More (1of 2)
Delete All
H 50.0 µs/
162.9679000 µs
T 660 mV
Measurements
Scales

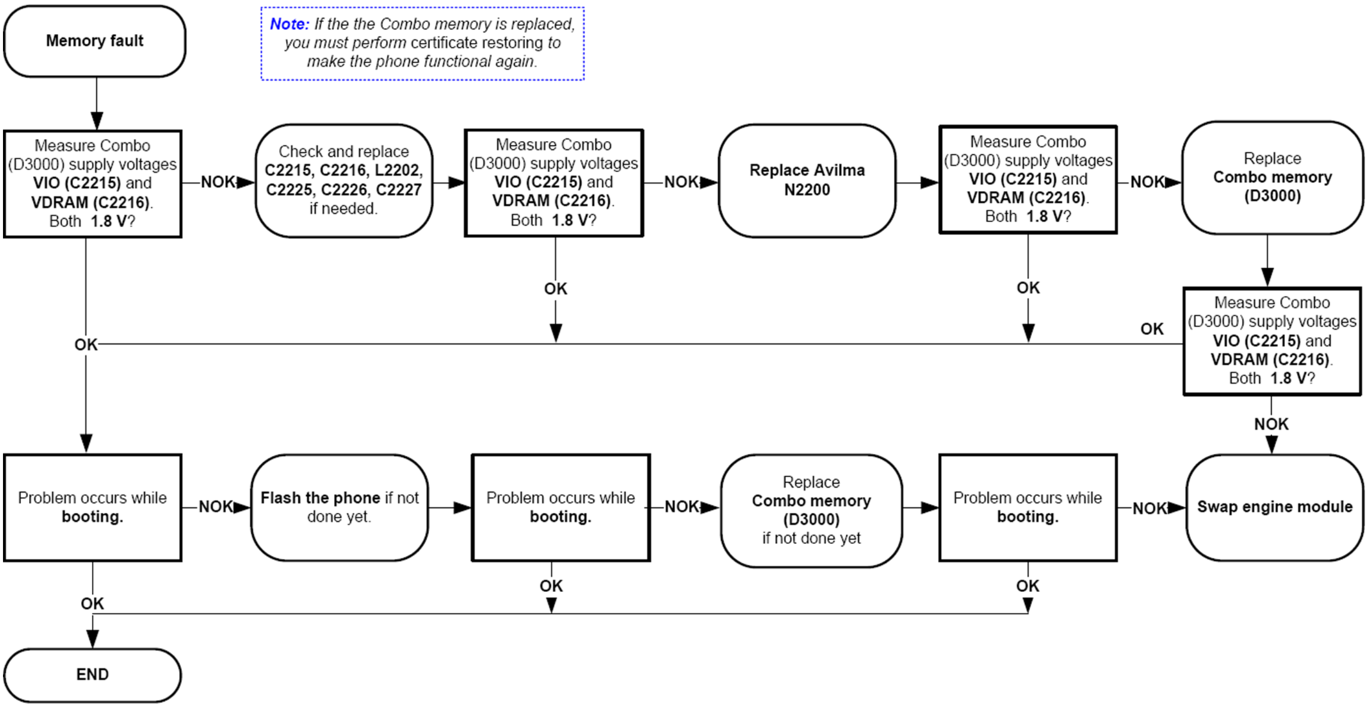
```
Acquisition is stopped.
2.00 MSa/s   1.00 Mpts
```

```
          V max(1)   V max(3)   V max(2)   V max(4)   Frequency(1●)
Current   2.858 V    2.619 V    2.898 V    2.858 V     99.96 kHz
   Mean   2.858 V    2.619 V    2.898 V    2.858 V     99.96 kHz
    Min   2.858 V    2.619 V    2.898 V    2.858 V     99.96 kHz
    Max   2.858 V    2.619 V    2.898 V    2.858 V     99.96 kHz
```

Figure 10 Take single trig measurement for the rise of the BSI signal.

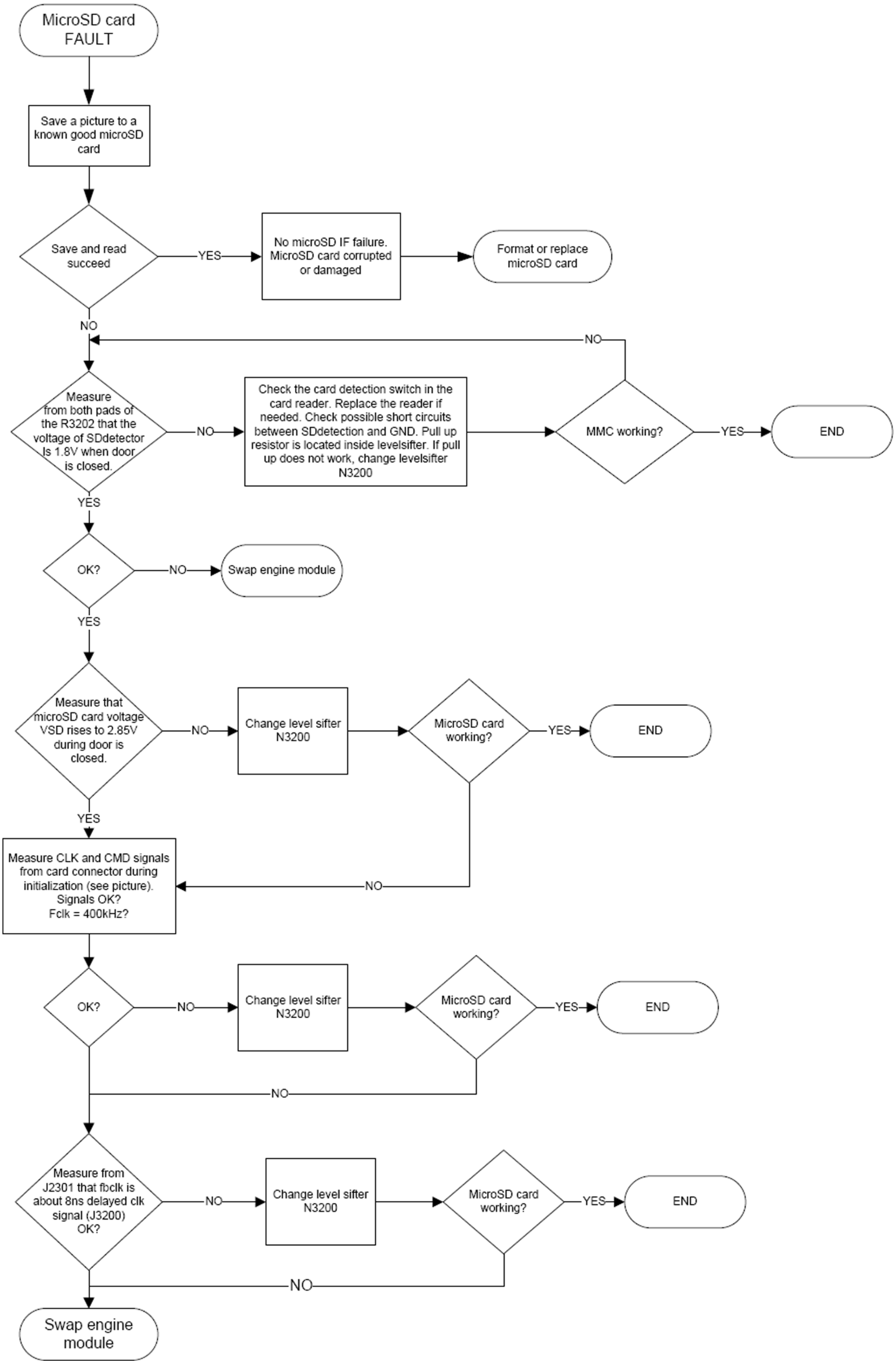
Combo memory troubleshooting

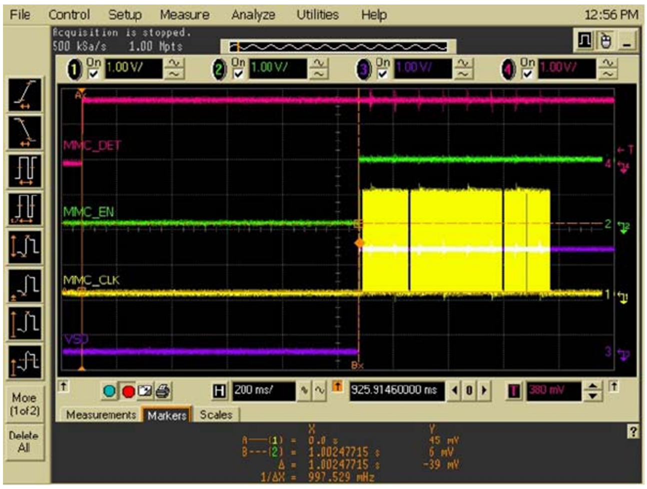
Troubleshooting flow


Memory fault
Note: If the the Combo memory is replaced, you must perform certificate restoring to make the phone functional again.
Measure Combo (D3000) supply voltages VIO (C2215) and VDRAM (C2216). Both 1.8 V?
NOK
Check and replace C2215, C2216, L2202, C2225, C2226, C2227 if needed.
Measure Combo (D3000) supply voltages VIO (C2215) and VDRAM (C2216). Both 1.8 V?
NOK
Replace Avilma N2200
Measure Combo (D3000) supply voltages VIO (C2215) and VDRAM (C2216). Both 1.8 V?
NOK
Replace Combo memory (D3000)
OK
OK
OK
OK
Measure Combo (D3000) supply voltages VIO (C2215) and VDRAM (C2216). Both 1.8 V?
NOK
Problem occurs while booting.
NOK
Flash the phone if not done yet.
Problem occurs while booting.
NOK
Replace Combo memory (D3000) if not done yet
Problem occurs while booting.
NOK
Swap engine module
OK
OK
OK
END

■ MicroSD card troubleshooting

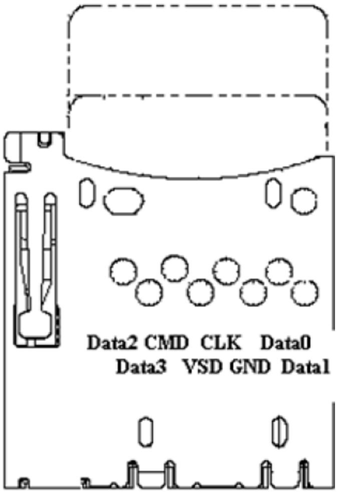
Troubleshooting flow


MicroSD card FAULT
Save a picture to a known good microSD card
Save and read succeed
YES
No microSD IF failure. MicroSD card corrupted or damaged
Format or replace microSD card
NO
NO
Measure from both pads of the R3202 that the voltage of SDdetector is 1.8V when door is closed.
NO
Check the card detection switch in the card reader. Replace the reader if needed. Check possible short circuits between SDdetection and GND. Pull up resistor is located inside levelsifter. If pull up does not work, change levelsifter N3200
MMC working?
YES
END
YES
OK?
NO
Swap engine module
YES
Measure that microSD card voltage VSD rises to 2.85V during door is closed.
NO
Change level sifter N3200
MicroSD card working?
YES
END
NO
YES
Measure CLK and CMD signals from card connector during initialization (see picture). Signals OK? Fclk = 400kHz?
OK?
NO
Change level sifter N3200
MicroSD card working?
YES
END
NO
Measure from J2301 that fbclk is about 8ns delayed clk signal (J3200) OK?
NO
Change level sifter N3200
MicroSD card working?
YES
END
NO
Swap engine module

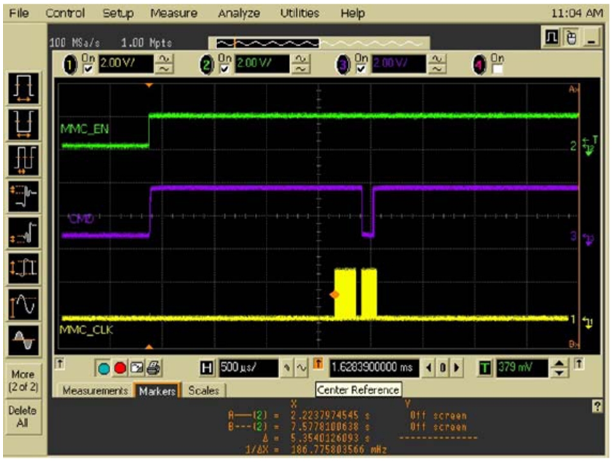

File
Control
Setup
Measure
Analyze
Utilities
Help
12:56 PM
Acquisition is stopped.
500 kSa/s 1.00 Mpts
1.00 V/
MMC_DET
MMC_EN
MMC_CLK
VSD
More (1 of 2)
Delete All
200 ms/
925.91460000 ms
380 mV
Measurements
Markers
Scales

```
                X                 Y
A——(1) =  0.0 s             45 mV
B---(2) =  1.00247715 s      6 mV
      Δ =  1.00247715 s    -39 mV
   1/ΔX =  997.529 mHz
```

MicroSD interface signals timing when door is closed.

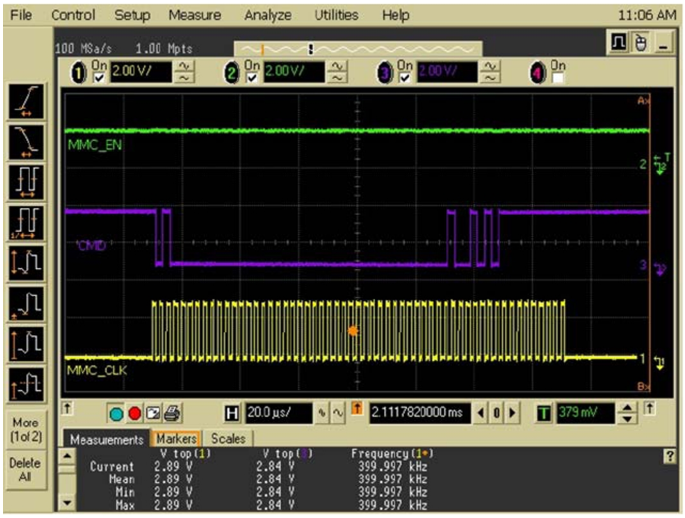

Data2 CMD CLK Data0
Data3 VSD GND Data1

MicroSD connector


File
Control
Setup
Measure
Analyze
Utilities
Help
11:04 AM
100 MSa/s 1.00 Mpts
2.00 V/
MMC_EN
CMD
MMC_CLK
More (2 of 2)
Delete All
500 µs/
1.6283900000 ms
379 mV
Measurements
Markers
Scales
Center Reference

```
                X                  Y
A——(2) =  2.2237974545 s    Off screen
B---(2) =  7.5778100638 s    Off screen
      Δ =  5.3540126093 s   -------------
   1/ΔX =  186.775803566 mHz
```

CLK and CMD signals during card initiaisation when card is not inserted. Measured from the microSD connector.

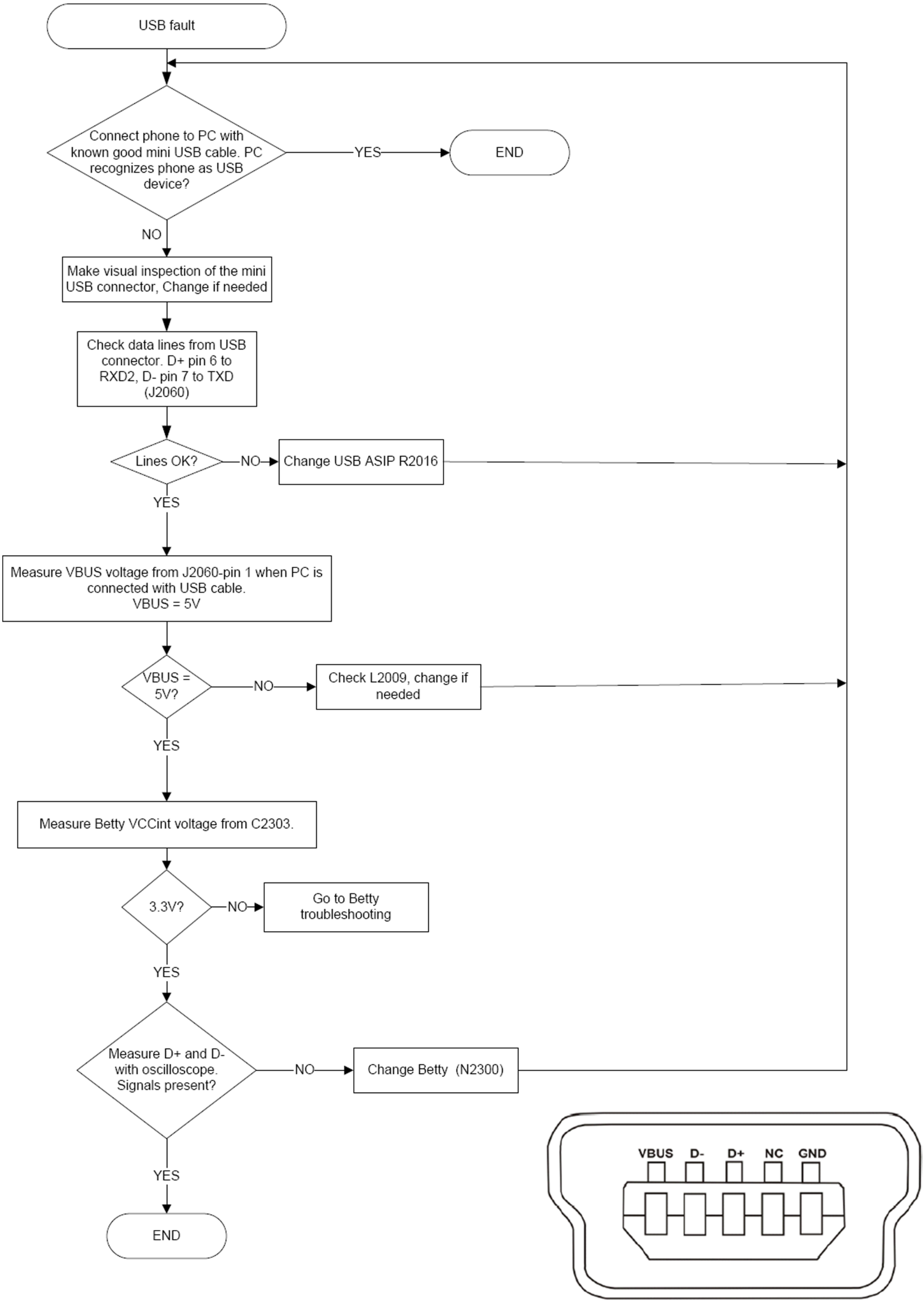

File
Control
Setup
Measure
Analyze
Utilities
Help
11:06 AM
100 MSa/s 1.00 Mpts
2.00 V/
MMC_EN
CMD
MMC_CLK
More (1 of 2)
Delete All
20.0 µs/
2.1117820000 ms
379 mV
Measurements
Markers
Scales

```
          V top(1)      V top(3)      Frequency(1*)
Current   2.89 V        2.84 V        399.997 kHz
   Mean   2.89 V        2.84 V        399.997 kHz
    Min   2.89 V        2.84 V        399.997 kHz
    Max   2.89 V        2.84 V        399.997 kHz
```

CLK and CMD signals during card initiaisation when card is not inserted. Measured from the microSD connector

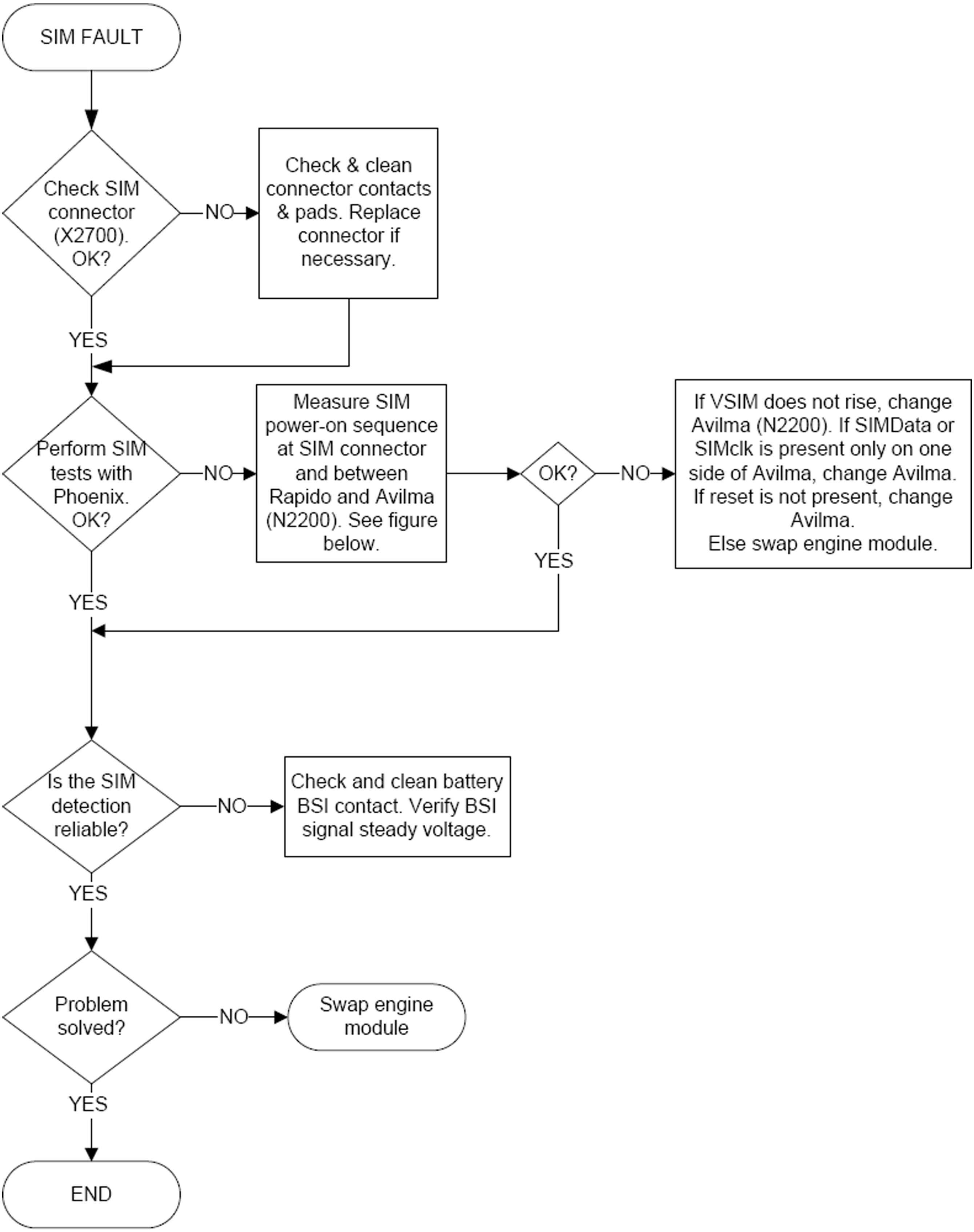
USB interface troubleshooting

Troubleshooting flow


USB fault
Connect phone to PC with known good mini USB cable. PC recognizes phone as USB device?
YES
END
NO
Make visual inspection of the mini USB connector, Change if needed
Check data lines from USB connector. D+ pin 6 to RXD2, D- pin 7 to TXD (J2060)
Lines OK?
NO
Change USB ASIP R2016
YES
Measure VBUS voltage from J2060-pin 1 when PC is connected with USB cable.
VBUS = 5V
VBUS = 5V?
NO
Check L2009, change if needed
YES
Measure Betty VCCint voltage from C2303.
3.3V?
NO
Go to Betty troubleshooting
YES
Measure D+ and D- with oscilloscope. Signals present?
NO
Change Betty (N2300)
YES
END
VBUS
D-
D+
NC
GND

SIM card troubleshooting

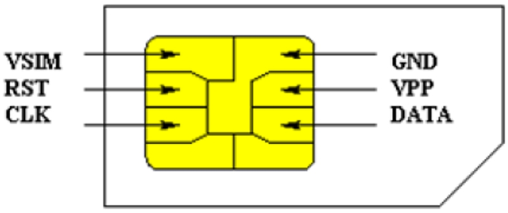
Troubleshooting flow


SIM FAULT
Check SIM connector (X2700). OK?
NO
Check & clean connector contacts & pads. Replace connector if necessary.
YES
Perform SIM tests with Phoenix. OK?
NO
Measure SIM power-on sequence at SIM connector and between Rapido and Avilma (N2200). See figure below.
OK?
NO
If VSIM does not rise, change Avilma (N2200). If SIMData or SIMclk is present only on one side of Avilma, change Avilma. If reset is not present, change Avilma. Else swap engine module.
YES
YES
Is the SIM detection reliable?
NO
Check and clean battery BSI contact. Verify BSI signal steady voltage.
YES
Problem solved?
NO
Swap engine module
YES
END

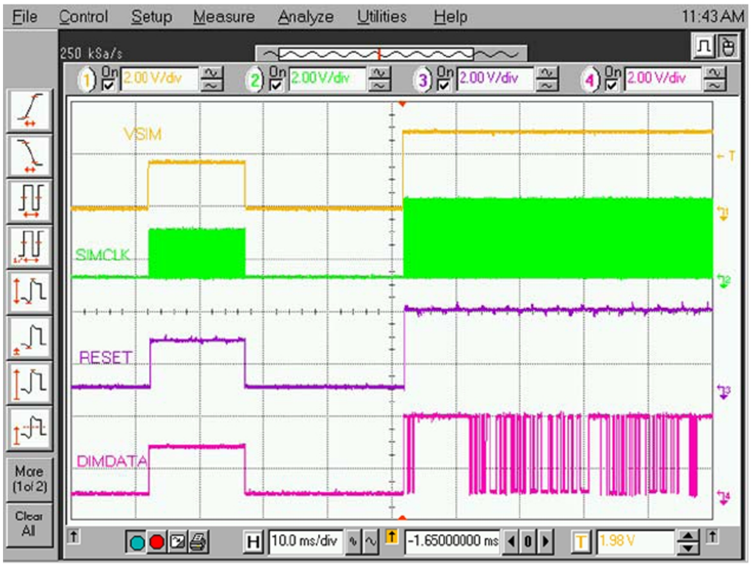
SIM power-on sequence

There are no test points between Avilma and RapidoYawe. Vsim, Data, Clk and reset must be measured from the SIM connector. The Vpp signal is not connected.

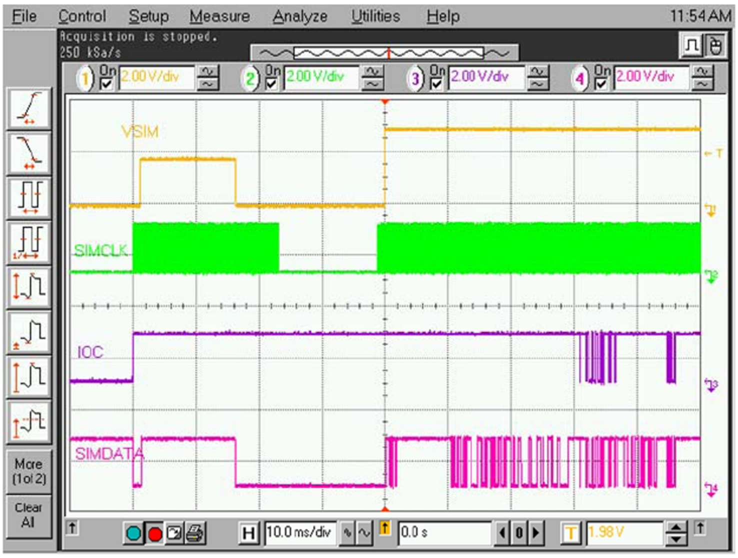
Fsimclk = 3.2MHz


VSIM
RST
CLK
GND
VPP
DATA

SIM contacts


File Control Setup Measure Analyze Utilities Help 11:43 AM
250 kSa/s
1 On 2.00 V/div
2 On 2.00 V/div
3 On 2.00 V/div
4 On 2.00 V/div
VSIM
SIMCLK
RESET
DIMDATA
More (1of 2)
Clear All
H 10.0 ms/div
-1.65000000 ms
T 1.98 V

SIM power-on sequence on X2700.


File Control Setup Measure Analyze Utilities Help 11:54 AM
Acquisition is stopped.
250 kSa/s
1 On 2.00 V/div
2 On 2.00 V/div
3 On 2.00 V/div
4 On 2.00 V/div
VSIM
SIMCLK
IOC
SIMDATA
More (1of 2)
Clear All
H 10.0 ms/div
0.0 s
T 1.98 V

SIM power-on sequence between Rapido and Avilma.

Keyboard troubleshooting

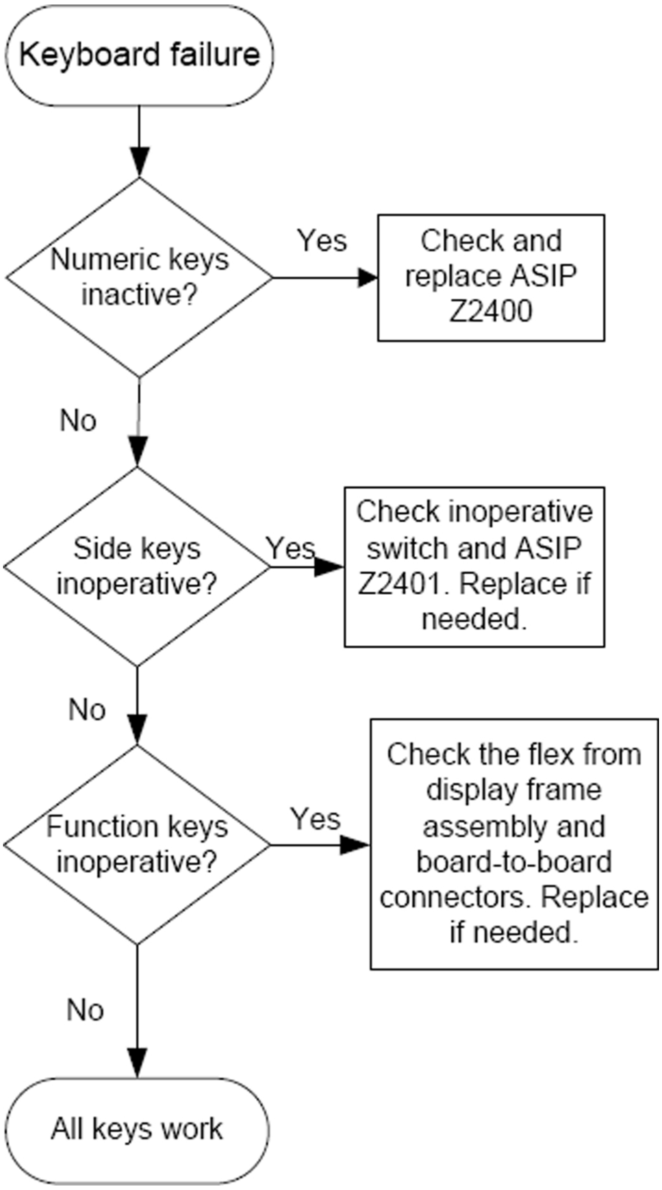
Context

There are two possible failure modes in the keyboard module:

- One or more keys can be stuck, so that the key does not react when a keydome is pressed. This kind of failure is caused by mechanical reasons (dirt, rust).
- Malfunction of several keys at the same time; this happens when one or more rows or columns are failing (shortcut or open connection). For a more detailed description of the keyboard and keymatrix, see section Keyboard.

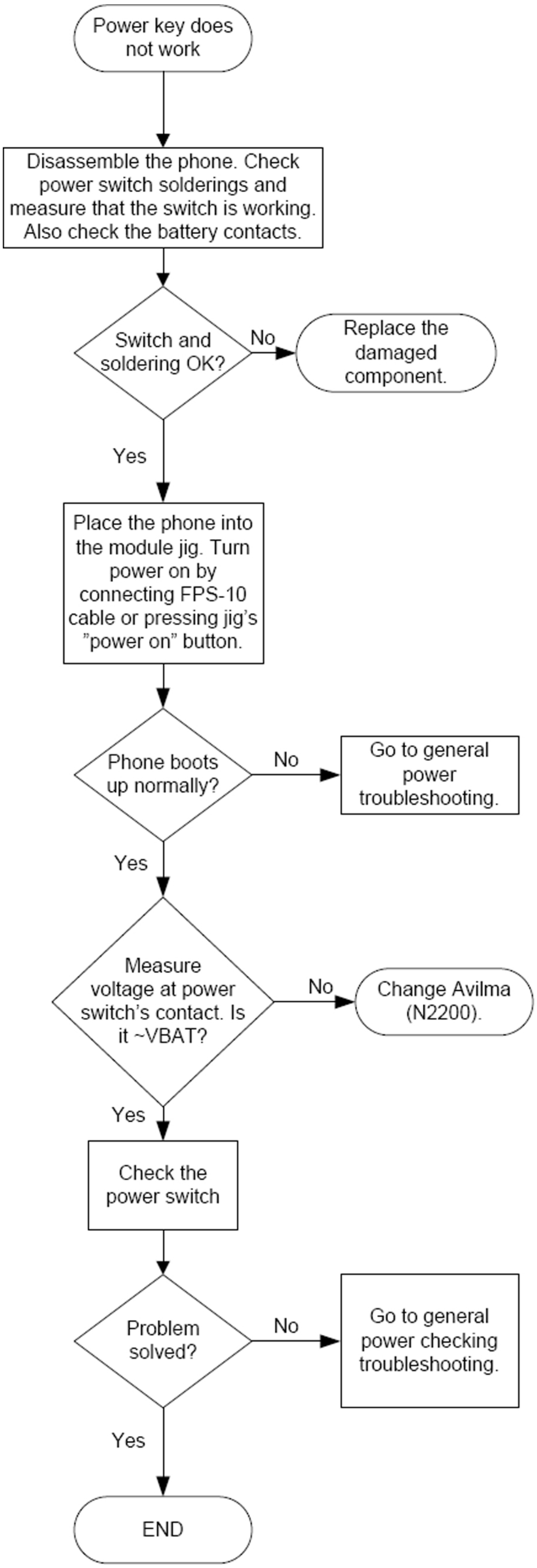
If the failure mode is not clear, start with the Keyboard Test in Phoenix.

Troubleshooting flow


Keyboard failure
Numeric keys inactive?
Yes
Check and replace ASIP Z2400
No
Side keys inoperative?
Yes
Check inoperative switch and ASIP Z2401. Replace if needed.
No
Function keys inoperative?
Yes
Check the flex from display frame assembly and board-to-board connectors. Replace if needed.
No
All keys work

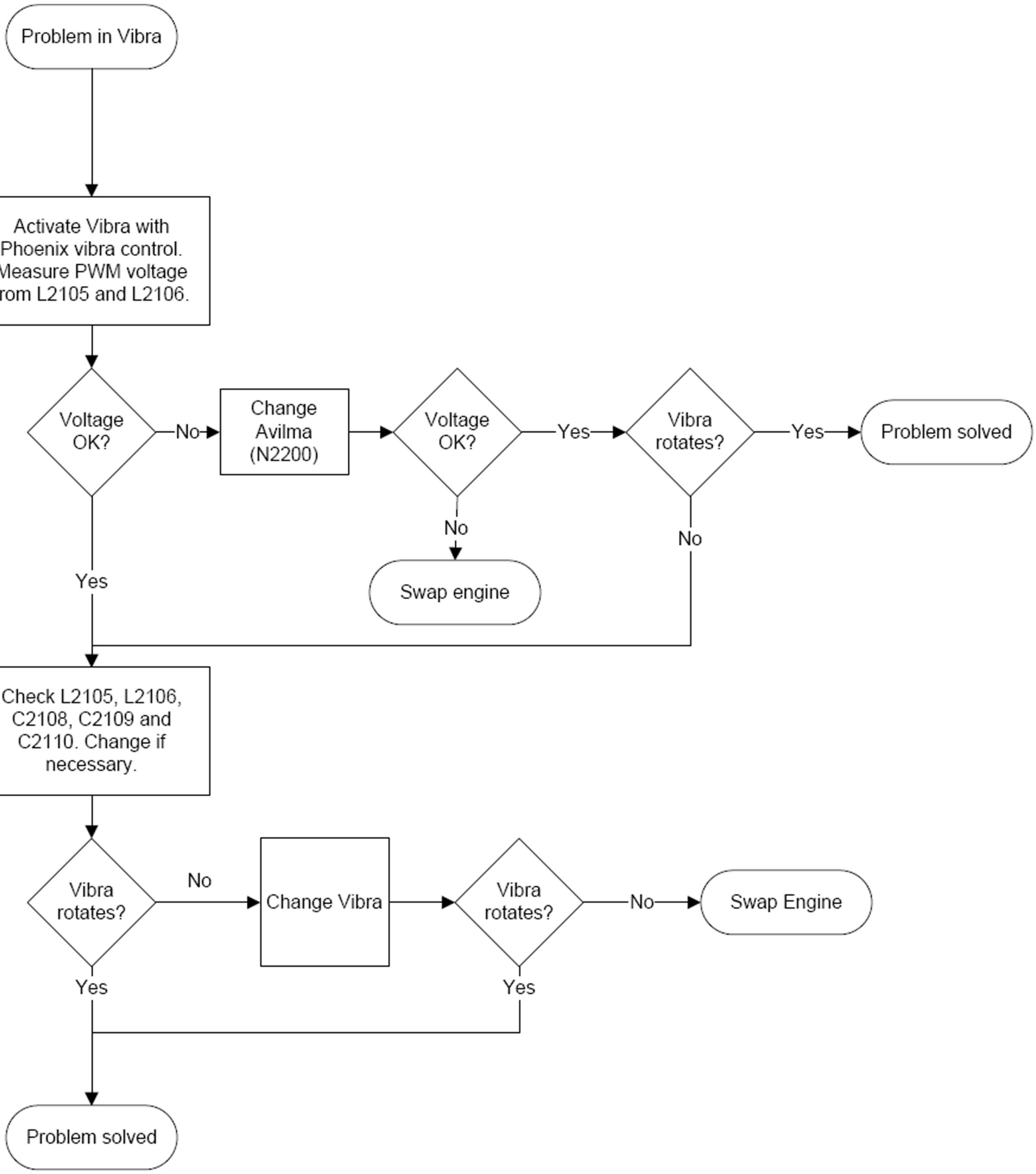
Power key troubleshooting

Troubleshooting flow


Power key does not work
Disassemble the phone. Check power switch solderings and measure that the switch is working. Also check the battery contacts.
Switch and soldering OK?
No
Replace the damaged component.
Yes
Place the phone into the module jig. Turn power on by connecting FPS-10 cable or pressing jig's "power on" button.
Phone boots up normally?
No
Go to general power troubleshooting.
Yes
Measure voltage at power switch's contact. Is it ~VBAT?
No
Change Avilma (N2200).
Yes
Check the power switch
Problem solved?
No
Go to general power checking troubleshooting.
Yes
END

Vibra troubleshooting

Troubleshooting flow


Problem in Vibra
Activate Vibra with Phoenix vibra control. Measure PWM voltage from L2105 and L2106.
Voltage OK?
No
Change Avilma (N2200)
Voltage OK?
Yes
Vibra rotates?
Yes
Problem solved
No
Swap engine
No
Yes
Check L2105, L2106, C2108, C2109 and C2110. Change if necessary.
Vibra rotates?
No
Change Vibra
Vibra rotates?
No
Swap Engine
Yes
Yes
Problem solved

Display module troubleshooting

General instructions for display troubleshooting

Context

- The display is in a normal mode when the phone is in active use.
- Display is in a partial idle mode when the phone is in the screen saver mode.

- The operating modes of the display can be controlled with the help of *Phoenix*.

Table 9 Display module troubleshooting cases

Display blank	There is no image on the display. The display looks the same when the phone is on as it does when the phone is off. The backlight can be on in some cases.
Image on the display not correct	Image on the display can be corrupted or a part of the image can be missing. If a part of the image is missing, change the display module. If the image is otherwise corrupted, follow the appropriate troubleshooting diagram.
Backlight dim or not working at all	Backlight LED components are inside the display module. Backlight failure can also be in the connector or in the backlight power source in the main engine of the phone. This means that in case the display is working (image OK), the backlight is faulty.
Visual defects (pixel)	Pixel defects can be checked by controlling the display with Phoenix. Use both colours, black and white, on a full screen. The display may have some random pixel defects that are acceptable for this type of display. The criteria when pixel defects are regarded as a display failure, resulting in a replacement of the display, are presented the following table.

Table 10 Pixel defects

Item		White dot defect				Black dot defect	Total
1	Defect counts	R	G	B	White Dot Total	1	1
		1	1	1	1		
2	Combined defect counts	Not allowed. Two single dot defects that are within 5 mm of each other should be interpreted as combined dot defect.					

Steps

1. Verify with a working display that the fault is not on the display module itself.

   The display module cannot be repaired.

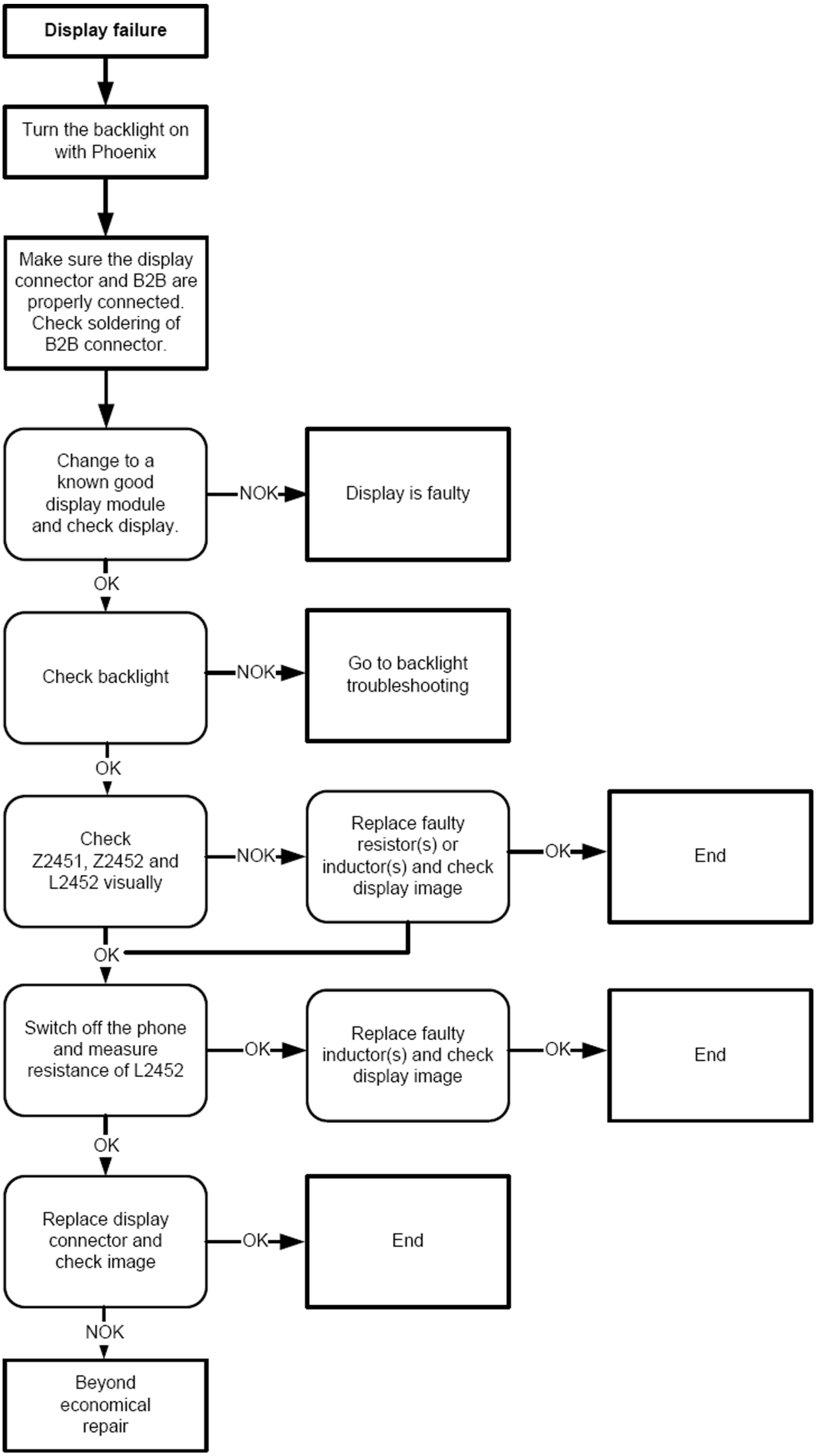
2. Check that the cellular engine is working normally.
   - i To check the functionality, connect the phone to a docking station.
   - ii Start *Phoenix* service software.
   - iii Read the phone information to check that also the application engine is functioning normally (you should be able to read the APE ID).

3. Proceed to the display troubleshooting flowcharts.

   Use the **Display Test** tool in *Phoenix* to find the detailed fault mode.

Display troubleshooting

Troubleshooting flow

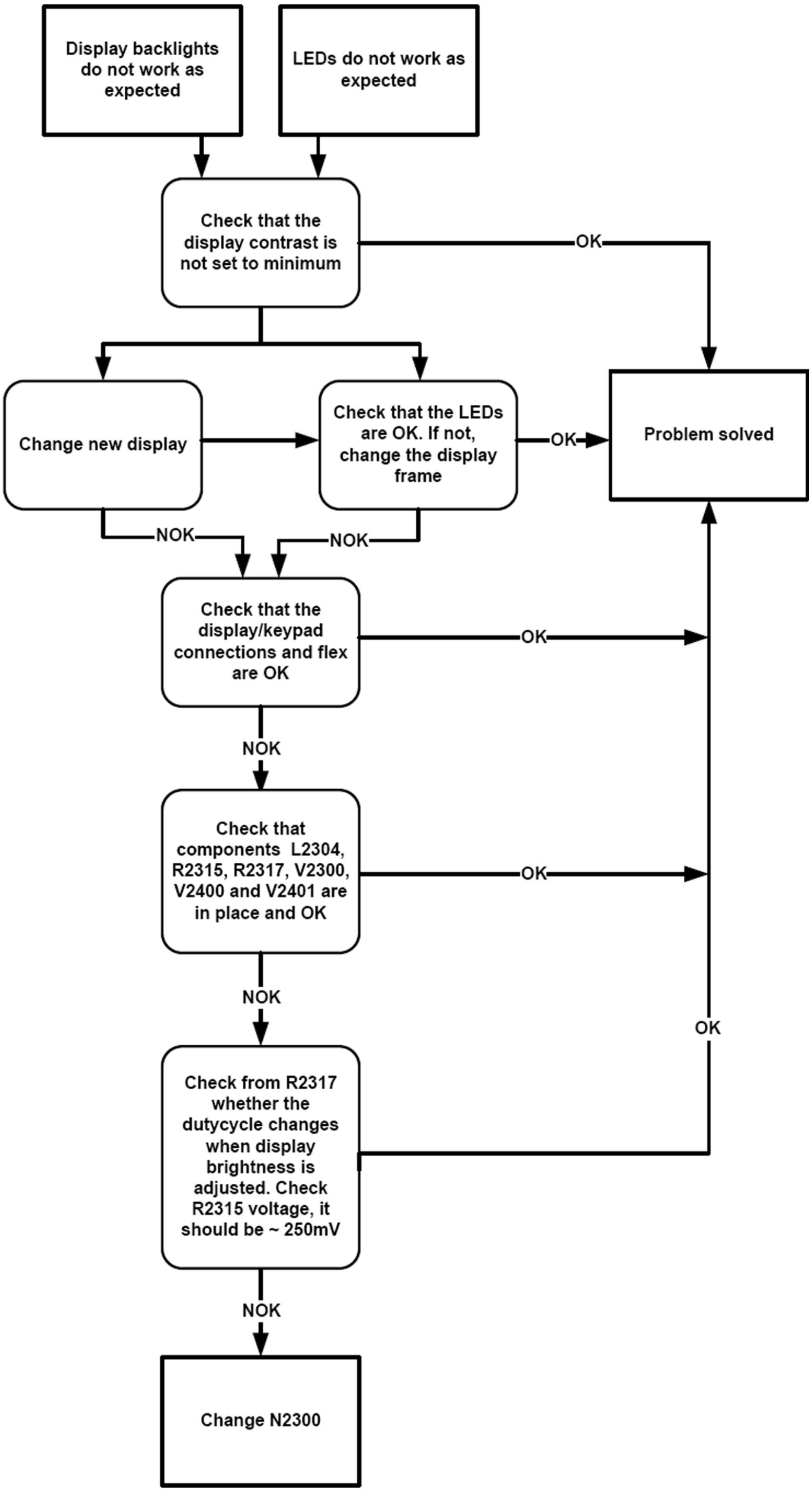

Display failure
Turn the backlight on with Phoenix
Make sure the display connector and B2B are properly connected. Check soldering of B2B connector.
Change to a known good display module and check display.
NOK
Display is faulty
OK
Check backlight
NOK
Go to backlight troubleshooting
OK
Check Z2451, Z2452 and L2452 visually
NOK
Replace faulty resistor(s) or inductor(s) and check display image
OK
End
OK
Switch off the phone and measure resistance of L2452
OK
Replace faulty inductor(s) and check display image
OK
End
OK
Replace display connector and check image
OK
End
NOK
Beyond economical repair

Backlights and LED driver troubleshooting

Context

The device has one LED driver that provides current for both the display and keyboard backlights. Brightness can be adjusted manually, and it affects both the display and keypad. Keyboard backlights can be turned ON/OFF separately but not without switching on the display lights.

Troubleshooting flow


Display backlights do not work as expected
LEDs do not work as expected
Check that the display contrast is not set to minimum
OK
Change new display
Check that the LEDs are OK. If not, change the display frame
OK
Problem solved
NOK
NOK
Check that the display/keypad connections and flex are OK
OK
NOK
Check that components L2304, R2315, R2317, V2300, V2400 and V2401 are in place and OK
OK
NOK
OK
Check from R2317 whether the dutycycle changes when display brightness is adjusted. Check R2315 voltage, it should be ~ 250mV
NOK
Change N2300

Bluetooth and FM radio

Introduction to Bluetooth/FM Radio troubleshooting

There are two main Bluetooth problems that can occur:

Problem	Description
Detachment of the BT antenna.	This would most likely happen if the device has been dropped repeatedly to the ground. It could cause the BT antenna to become loose or partially detached from the PWB.
A malfunction in the BT ASIC, BB ASICs or Phone's BT SMD components.	This is unpredictable and could have many causes i.e. SW or HW related.

The main issue is to find out if the problem is related to the BT antenna or related to the BT system or the phone's BB and then replace/fix the faulty component.

Bluetooth antenna

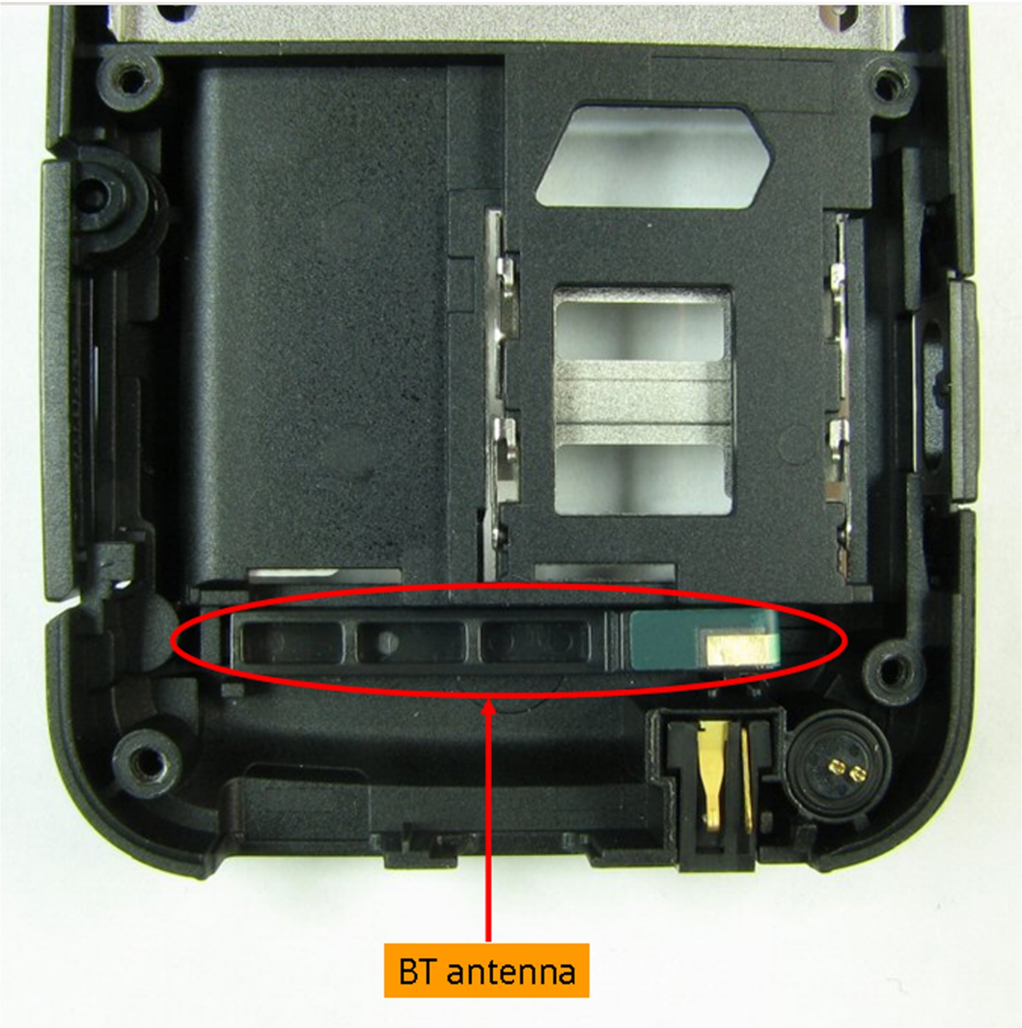


Figure 11 RM-243 Bluetooth antenna

Bluetooth/FM Radio component layout

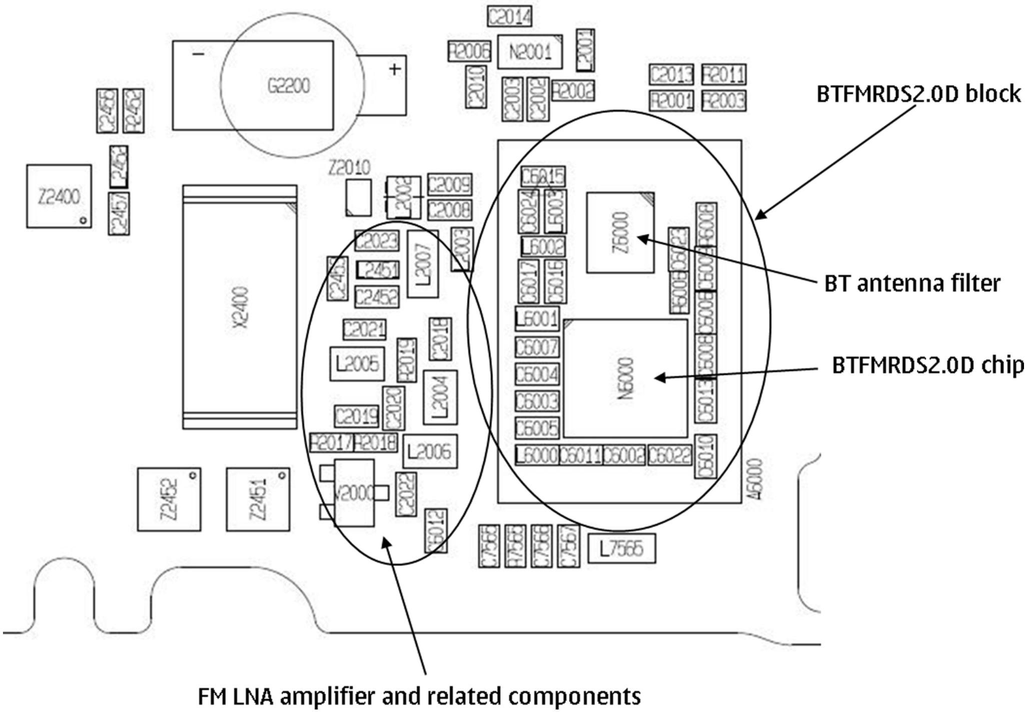

BTFMRDS2.0D block
BT antenna filter
BTFMRDS2.0D chip
FM LNA amplifier and related components
G2200
X2400
Z2400
Z2452
Z2451
Z2010
N2001
C2014
R2006
L2007
L2005
L2004
L2006
V2000
N6000
Z6000
L6001
L6002
L7565

Figure 12 RM-243 Bluetooth and FM radio component layout

Bluetooth settings for Phoenix

Steps

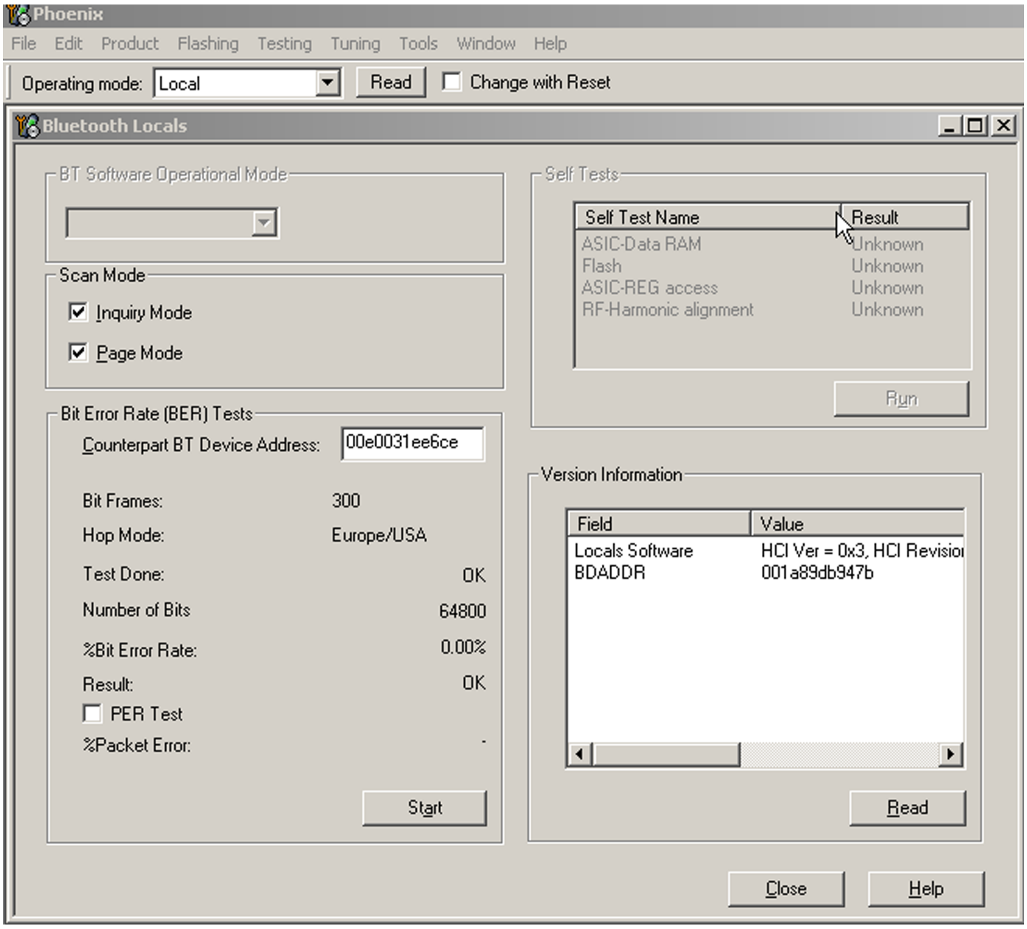
1. Start *Phoenix* service software.
2. From the **File** menu, choose **Open Product**, and then choose the correct type designator from the **Product** list.
3. Place the phone to a flash adapter in the local mode.
4. Choose **Testing→Bluetooth LOCALS** .
5. Locate SB-6's serial number (12 digits) found in the type label on the back of SB-6.

   In addition to SB-6 , also JBT-3, JBT-6 and JBT-9 Bluetooth test boxes can be used.
6. In the *Bluetooth LOCALS* window, write the 12-digit serial number on the **Counterpart BT Device Address** line.

   This needs to be done only once provided that SB-6 is not changed.
7. Place the SB-6 box near (within 10 cm) the BT antenna and click **Run BER Test**.

Results

Bit Error Rate test result is displayed in the *Bit Error Rate (BER) Tests* pane in the *Bluetooth LOCALS* window.


Phoenix
File Edit Product Flashing Testing Tuning Tools Window Help
Read
Bluetooth Locals
BT Software Operational Mode
Scan Mode
Bit Error Rate (BER) Tests
Self Tests
Run
Version Information
Start
Read
Close
Help

Operating mode: Local
☐ Change with Reset

☑ Inquiry Mode
☑ Page Mode

Counterpart BT Device Address: 00e0031ee6ce

Bit Frames: 300
Hop Mode: Europe/USA
Test Done: OK
Number of Bits 64800
%Bit Error Rate: 0.00%
Result: OK
☐ PER Test
%Packet Error: -

Self Test Name	Result
ASIC-Data RAM	Unknown
Flash	Unknown
ASIC-REG access	Unknown
RF-Harmonic alignment	Unknown

Field	Value
Locals Software	HCI Ver = 0x3, HCI Revisio
BDADDR	001a89db947b

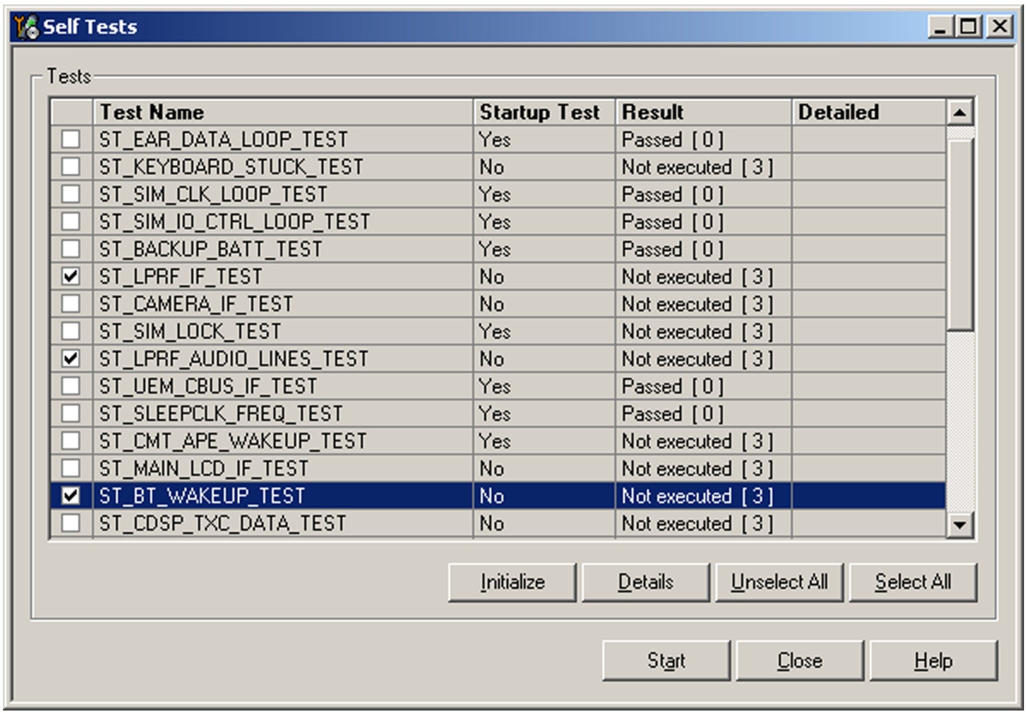
Figure 13 BER test result

Bluetooth self tests in Phoenix

Steps

1. Start *Phoenix* service software.
2. Choose**File→Scan Product.**
3. Place the phone to a flash adapter.
4. From the **Mode** drop-down menu, set mode to **Local**.
5. Choose **Testing→Self Tests.**
6. In the *Self Tests* window check the following Bluetooth related tests:
   - **ST_LPRF_IF_TEST**
   - **ST_LPRF_AUDIO_LINES_TEST**
   - **ST_BT_WAKEUP_TEST**

7. To run the tests, click **Start**.

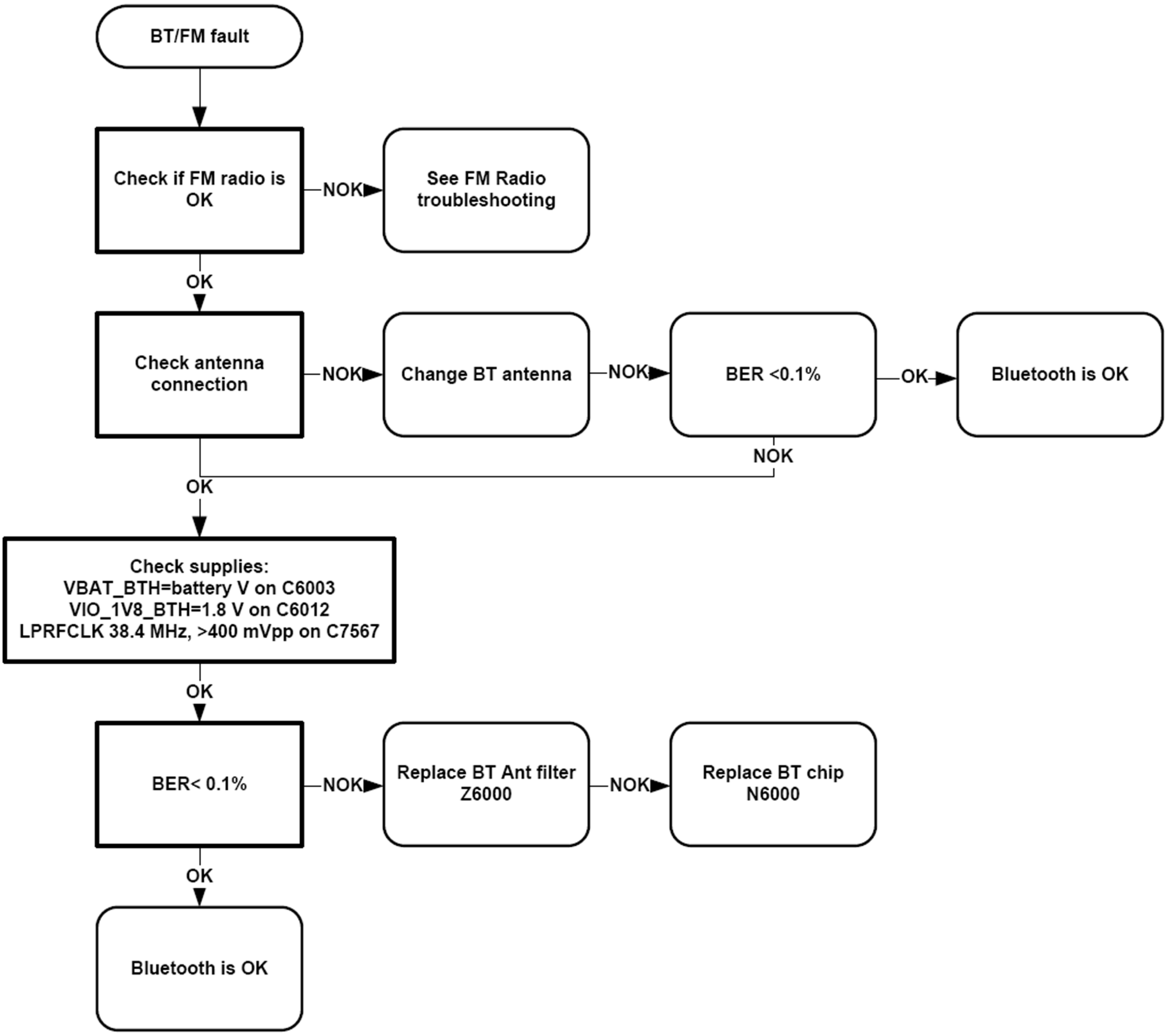


	Test Name	Startup Test	Result	Detailed
☐	ST_EAR_DATA_LOOP_TEST	Yes	Passed [0]	
☐	ST_KEYBOARD_STUCK_TEST	No	Not executed [3]	
☐	ST_SIM_CLK_LOOP_TEST	Yes	Passed [0]	
☐	ST_SIM_IO_CTRL_LOOP_TEST	Yes	Passed [0]	
☐	ST_BACKUP_BATT_TEST	Yes	Passed [0]	
☑	ST_LPRF_IF_TEST	No	Not executed [3]	
☐	ST_CAMERA_IF_TEST	No	Not executed [3]	
☐	ST_SIM_LOCK_TEST	Yes	Not executed [3]	
☑	ST_LPRF_AUDIO_LINES_TEST	No	Not executed [3]	
☐	ST_UEM_CBUS_IF_TEST	Yes	Passed [0]	
☐	ST_SLEEPCLK_FREQ_TEST	Yes	Passed [0]	
☐	ST_CMT_APE_WAKEUP_TEST	Yes	Not executed [3]	
☐	ST_MAIN_LCD_IF_TEST	No	Not executed [3]	
☑	ST_BT_WAKEUP_TEST	No	Not executed [3]	
☐	ST_CDSP_TXC_DATA_TEST	No	Not executed [3]	

Figure 14 Bluetooth self tests in *Phoenix*

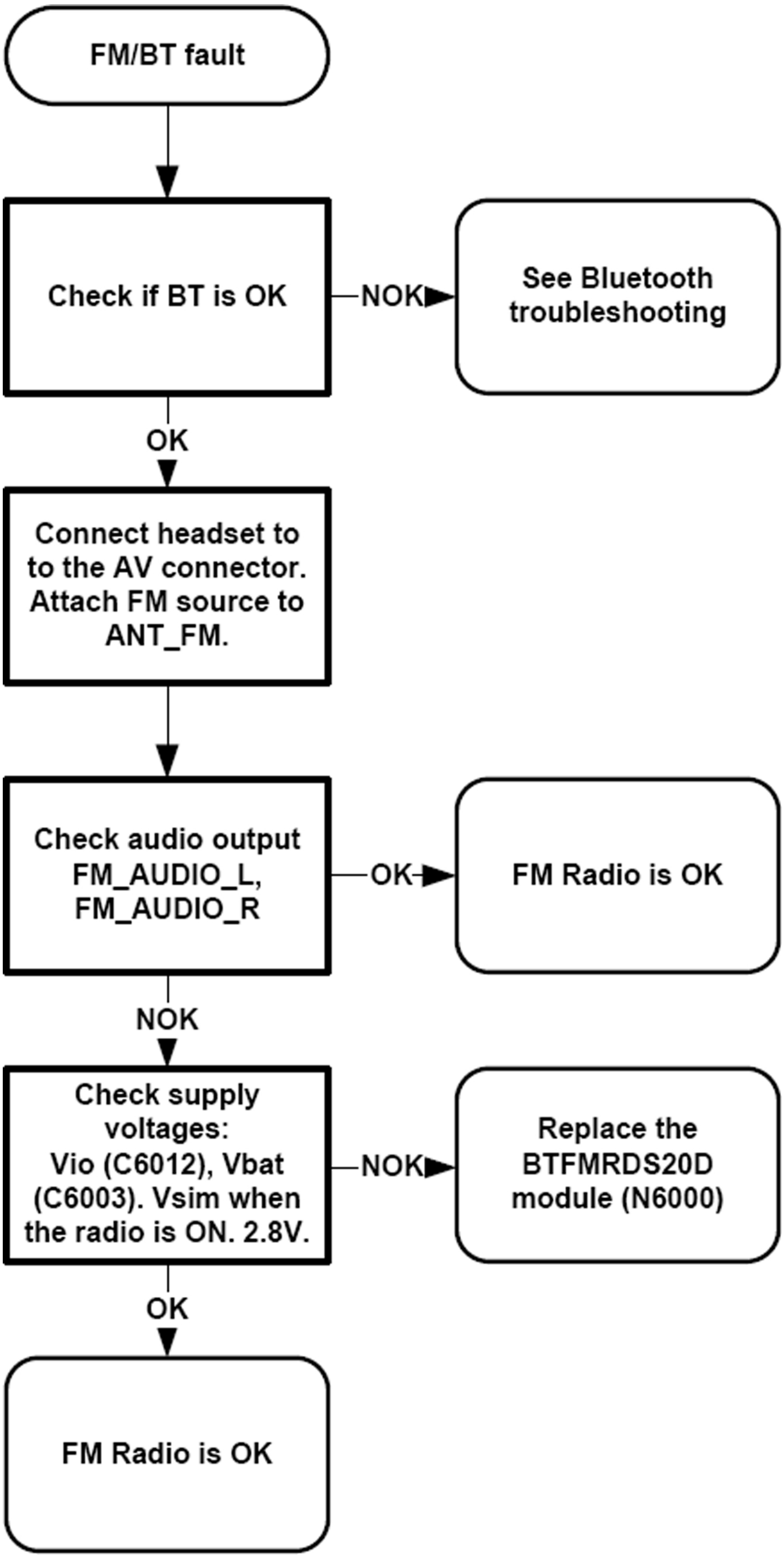
Bluetooth troubleshooting

Troubleshooting flow


BT/FM fault
Check if FM radio is OK
NOK
See FM Radio troubleshooting
OK
Check antenna connection
NOK
Change BT antenna
NOK
BER <0.1%
OK
Bluetooth is OK
NOK
OK
Check supplies:
VBAT_BTH=battery V on C6003
VIO_1V8_BTH=1.8 V on C6012
LPRFCLK 38.4 MHz, >400 mVpp on C7567
OK
BER< 0.1%
NOK
Replace BT Ant filter Z6000
NOK
Replace BT chip N6000
OK
Bluetooth is OK

FM radio troubleshooting

Troubleshooting flow


FM/BT fault
Check if BT is OK
NOK
See Bluetooth troubleshooting
OK
Connect headset to to the AV connector. Attach FM source to ANT_FM.
Check audio output FM_AUDIO_L, FM_AUDIO_R
OK
FM Radio is OK
NOK
Check supply voltages: Vio (C6012), Vbat (C6003). Vsim when the radio is ON. 2.8V.
NOK
Replace the BTFMRDS20D module (N6000)
OK
FM Radio is OK

Audio troubleshooting

Audio troubleshooting test instructions

Single-ended external earpiece and differential internal earpiece outputs can be measured either with a single-ended or a differential probe.

When measuring with a single-ended probe each output is measured against the ground.

Internal handsfree output is measured using a current probe, if a special low-pass filter designed for measuring a digital amplifier is not available. Note also that when using a current probe, the input signal frequency must be set to 2kHz.

The input signal for each loop test can be either single-ended or differential. Exception to this is a digital microphone, which needs input signal from an external sound source (laptop speaker) to playback eg. 1kHz sine wave from 5cm distance.

Required equipment

The following equipment is needed for the tests:

- Oscilloscope
- Function generator (sine waveform)
- Current probe (Internal handsfree PWM output measurement)
- Phoenix service software
- Battery voltage 3.7V
- Sound source (laptop speaker or B&K type 4231 calibrator)

Test procedure

Audio can be tested using the Phoenix audio routings option. Three different audio loop paths can be activated:

- External microphone to Internal earpiece
- External microphone to Internal handsfree speaker
- HP microphone to External earpiece

Each audio loop sets routing from the specified input to the specified output enabling a quick in-out test. Loop path gains are fixed and they cannot be changed using Phoenix. Correct pins and signals for each test are presented in the following table.

Phoenix audio loop tests and test results

The results presented in the table apply when no accessory is connected and battery voltage is set to 3.7V.

Earpiece, internal microphone and speaker are in place during measurement. Applying a headset accessory during measurement causes a significant drop in measured quantities.

The gain values presented in the table apply for a differential output vs. single-ended/differential input.

Loop test	Input terminal	Output terminal	Path gain [dB] (fixed)	Input voltage [mVp-p]	Output voltage [mVp-p]	Output DC level [V]	Output current [mA]
External Mic to External Earpiece	HS_MIC & GND	HS_EAR_L & GND	-8.6	1000	367	1.2	NA
		HS_EAR_R & GND					
External Mic to Internal Earpiece	HS_MIC & GND	EarP & GND	-10	1000	310	1.2	NA
		EarN & GND					
External Mic to Internal handsfree	HS_MIC & GND	J2100	-6	1000			
		J2101					
Digital Mic to External Earpiece	Acoustical input, 1kHz sine wave	HS_EAR_L & GND	NA	94 dB SPL	100		NA
		HS_EAR_R & GND					

Measurement data

Earpiece signal

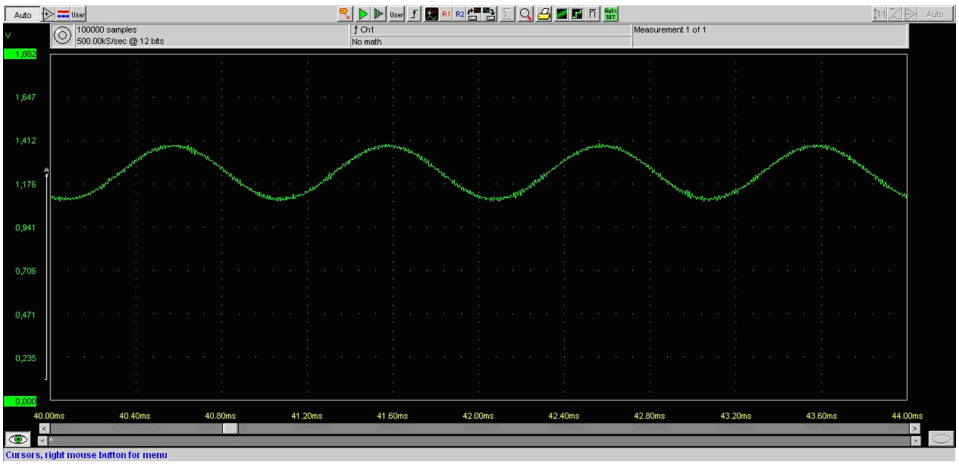

Auto
User
User
R1
R2
Auto SET
Auto
100000 samples
500.00kS/sec @ 12 bits
ƒ Ch1
No math
Measurement 1 of 1
V
1,882
1,647
1,412
1,176
0,941
0,706
0,471
0,235
0,000
40.00ms
40.40ms
40.80ms
41.20ms
41.60ms
42.00ms
42.40ms
42.80ms
43.20ms
43.60ms
44.00ms
Cursors, right mouse button for menu

Figure 15 Single-ended output waveform of the Ext_in_HP_out measurement when earpiece is connected.

Integrated handsfree signal

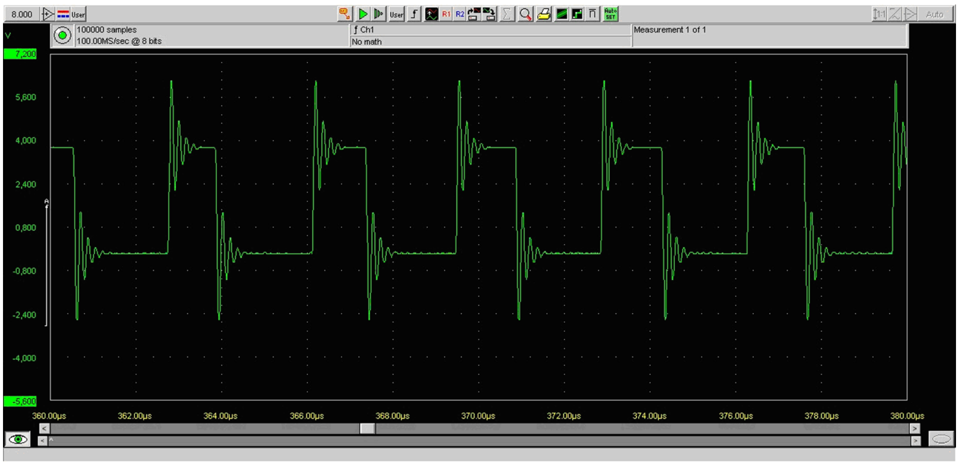

8.000
User
100000 samples
100.00MS/sec @ 8 bits
ƒ Ch1
No math
Measurement 1 of 1
Auto
V
7,200
5,600
4,000
2,400
0,800
-0,800
-2,400
-4,000
-5,600
360.00µs
362.00µs
364.00µs
366.00µs
368.00µs
370.00µs
372.00µs
374.00µs
376.00µs
378.00µs
380.00µs

Figure 16 Single-ended output waveform of the Ext_in_IHF_out out loop measurement when speaker is connected (measured at speaker pads). No filter is used.

External output from AV

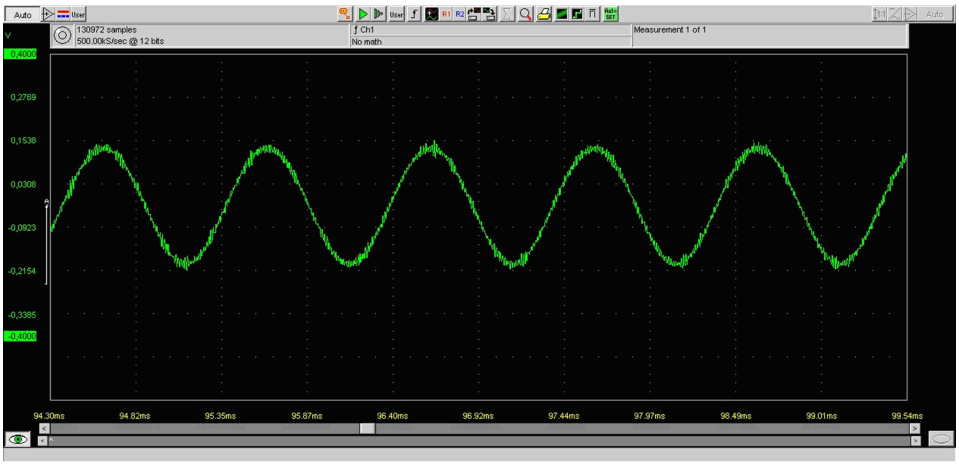

Auto
User
130972 samples
500.00kS/sec @ 12 bits
ƒ Ch1
No math
Measurement 1 of 1
Auto
V
0,4000
0,2769
0,1538
0,0308
-0,0923
-0,2154
-0,3385
-0,4000
94.30ms
94.82ms
95.35ms
95.87ms
96.40ms
96.92ms
97.44ms
97.97ms
98.49ms
99.01ms
99.54ms

Figure 17 Single-ended output waveform of the Ext_in_Ext_out loop.

External output from AV (acoustic input)

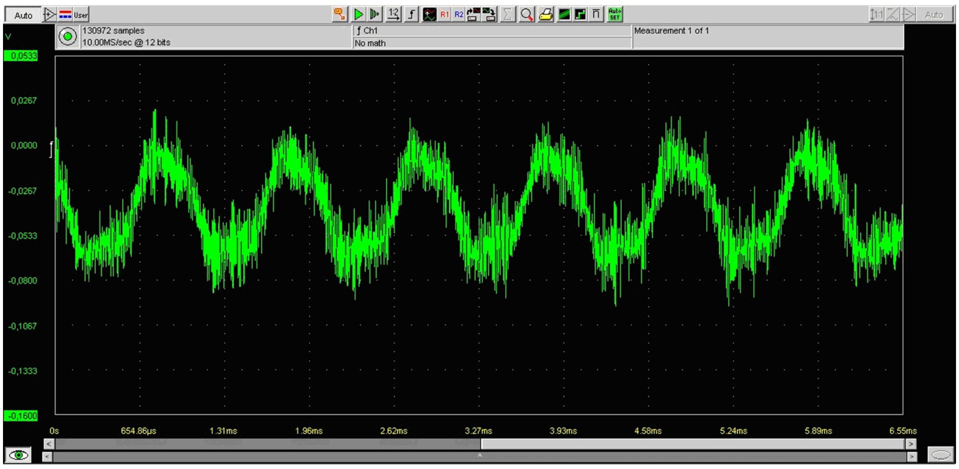
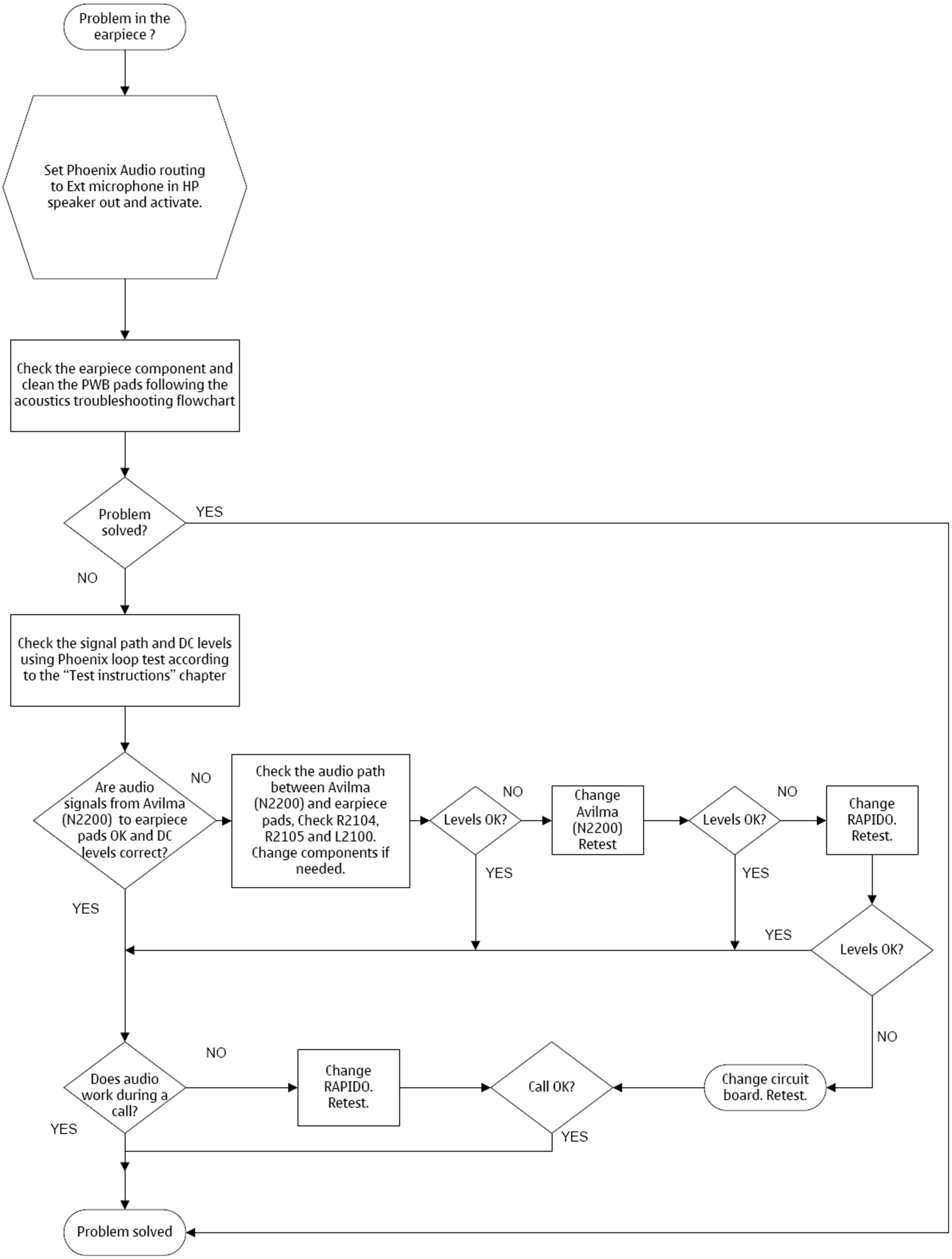

Auto
User
130972 samples
10.00MS/sec @ 12 bits
ƒ Ch1
No math
Measurement 1 of 1
Auto
V
0,0533
0,0267
0,0000
-0,0267
-0,0533
-0,0800
-0,1067
-0,1333
-0,1600
0s
654.86µs
1.31ms
1.96ms
2.62ms
3.27ms
3.93ms
4.58ms
5.24ms
5.89ms
6.55ms

Figure 18 Single-ended output waveform of the HP_microphone_in_Ext_out loop.

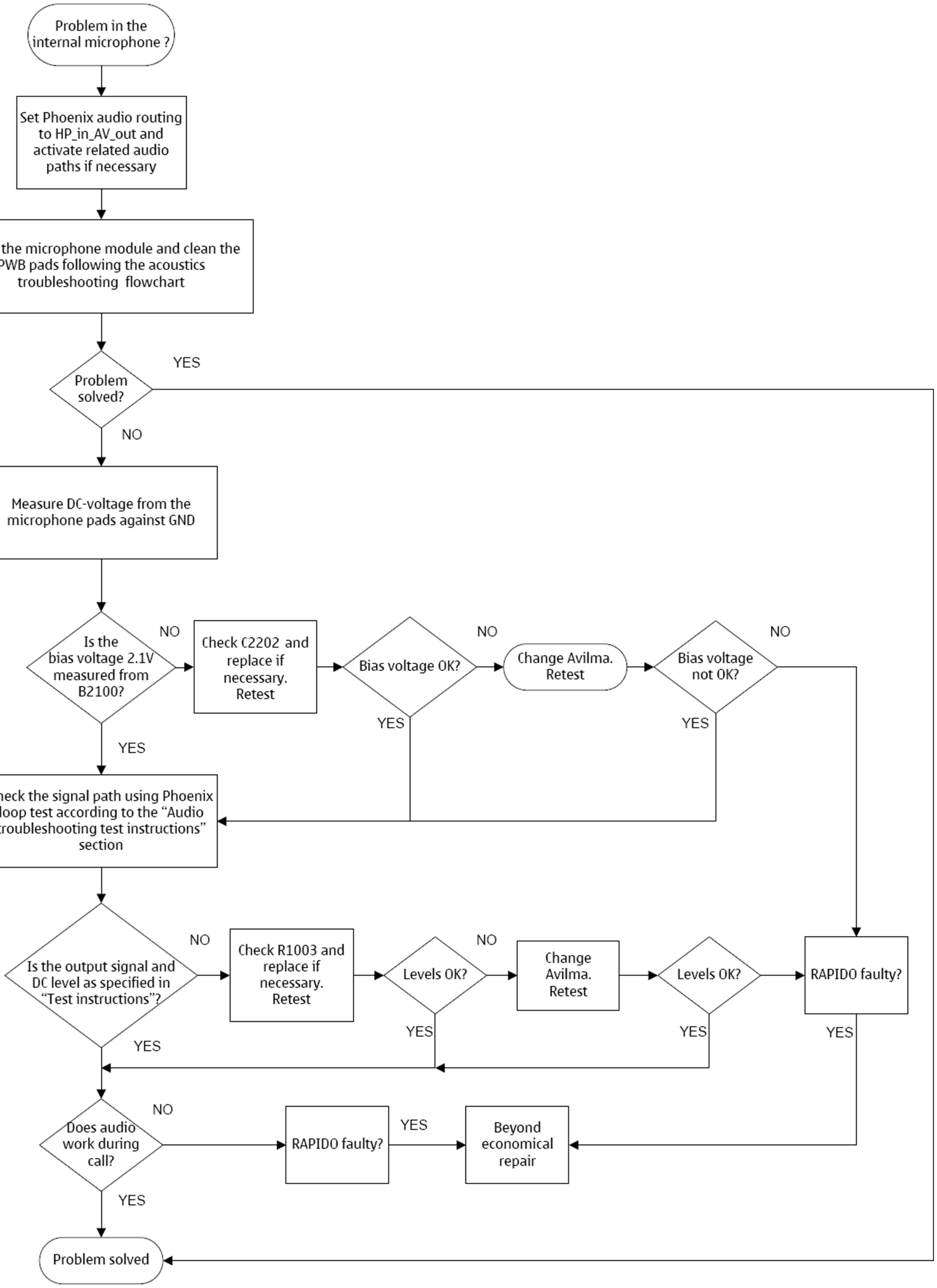
Internal earpiece troubleshooting

Troubleshooting flow


Problem in the earpiece ?
Set Phoenix Audio routing to Ext microphone in HP speaker out and activate.
Check the earpiece component and clean the PWB pads following the acoustics troubleshooting flowchart
Problem solved?
YES
NO
Check the signal path and DC levels using Phoenix loop test according to the "Test instructions" chapter
Are audio signals from Avilma (N2200) to earpiece pads OK and DC levels correct?
NO
YES
Check the audio path between Avilma (N2200) and earpiece pads, Check R2104, R2105 and L2100. Change components if needed.
Levels OK?
NO
YES
Change Avilma (N2200) Retest
Levels OK?
NO
YES
Change RAPIDO. Retest.
Levels OK?
YES
NO
Does audio work during a call?
NO
YES
Change RAPIDO. Retest.
Call OK?
YES
Change circuit board. Retest.
Problem solved

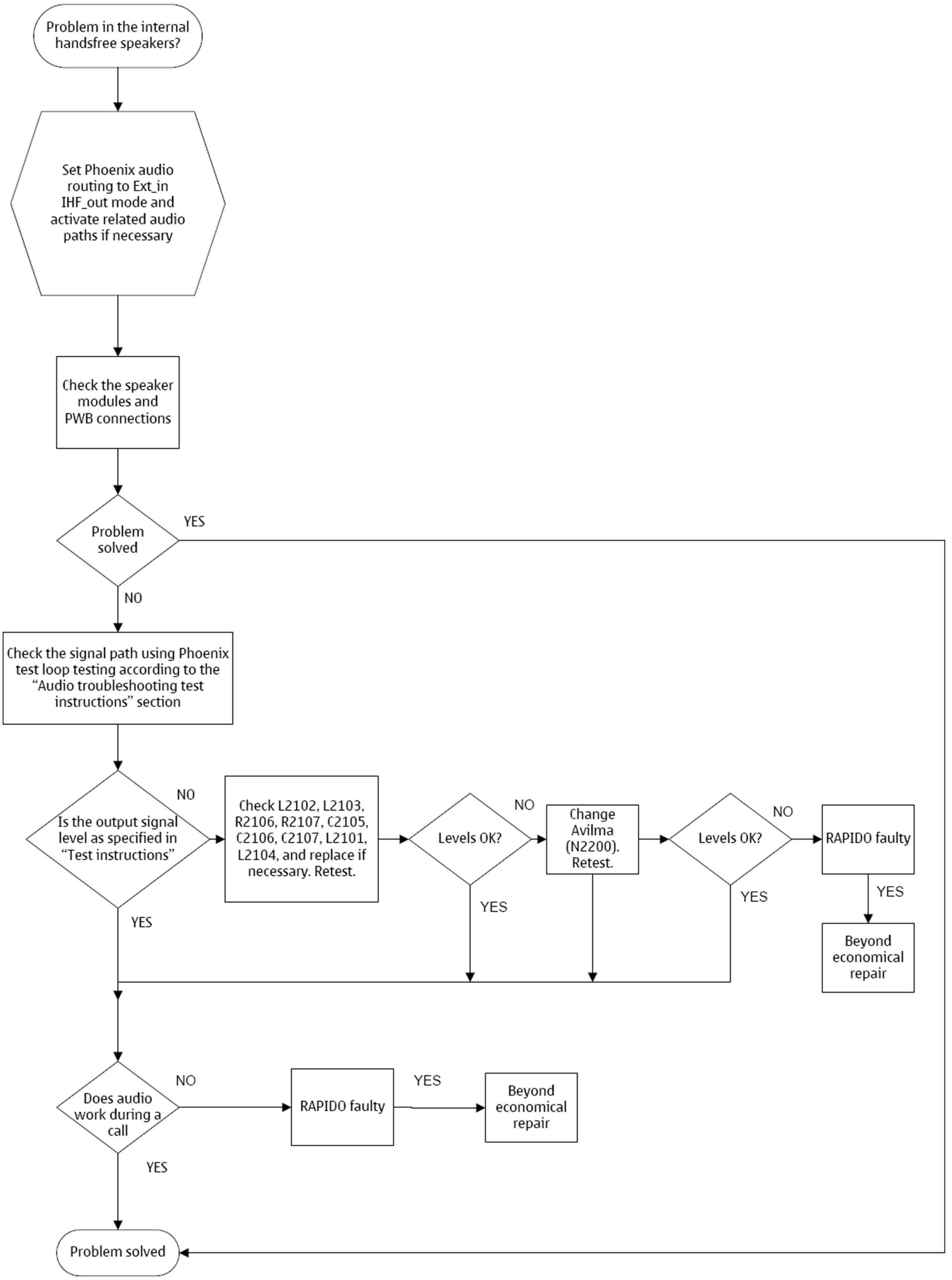
Internal microphone troubleshooting

Troubleshooting flow


Problem in the internal microphone ?
Set Phoenix audio routing to HP_in_AV_out and activate related audio paths if necessary
Check the microphone module and clean the PWB pads following the acoustics troubleshooting flowchart
Problem solved?
YES
NO
Measure DC-voltage from the microphone pads against GND
Is the bias voltage 2.1V measured from B2100?
NO
Check C2202 and replace if necessary. Retest
Bias voltage OK?
NO
Change Avilma. Retest
Bias voltage not OK?
NO
YES
YES
YES
Check the signal path using Phoenix loop test according to the “Audio troubleshooting test instructions” section
Is the output signal and DC level as specified in “Test instructions”?
NO
Check R1003 and replace if necessary. Retest
Levels OK?
NO
Change Avilma. Retest
Levels OK?
RAPIDO faulty?
YES
YES
YES
YES
Does audio work during call?
NO
RAPIDO faulty?
YES
Beyond economical repair
YES
Problem solved

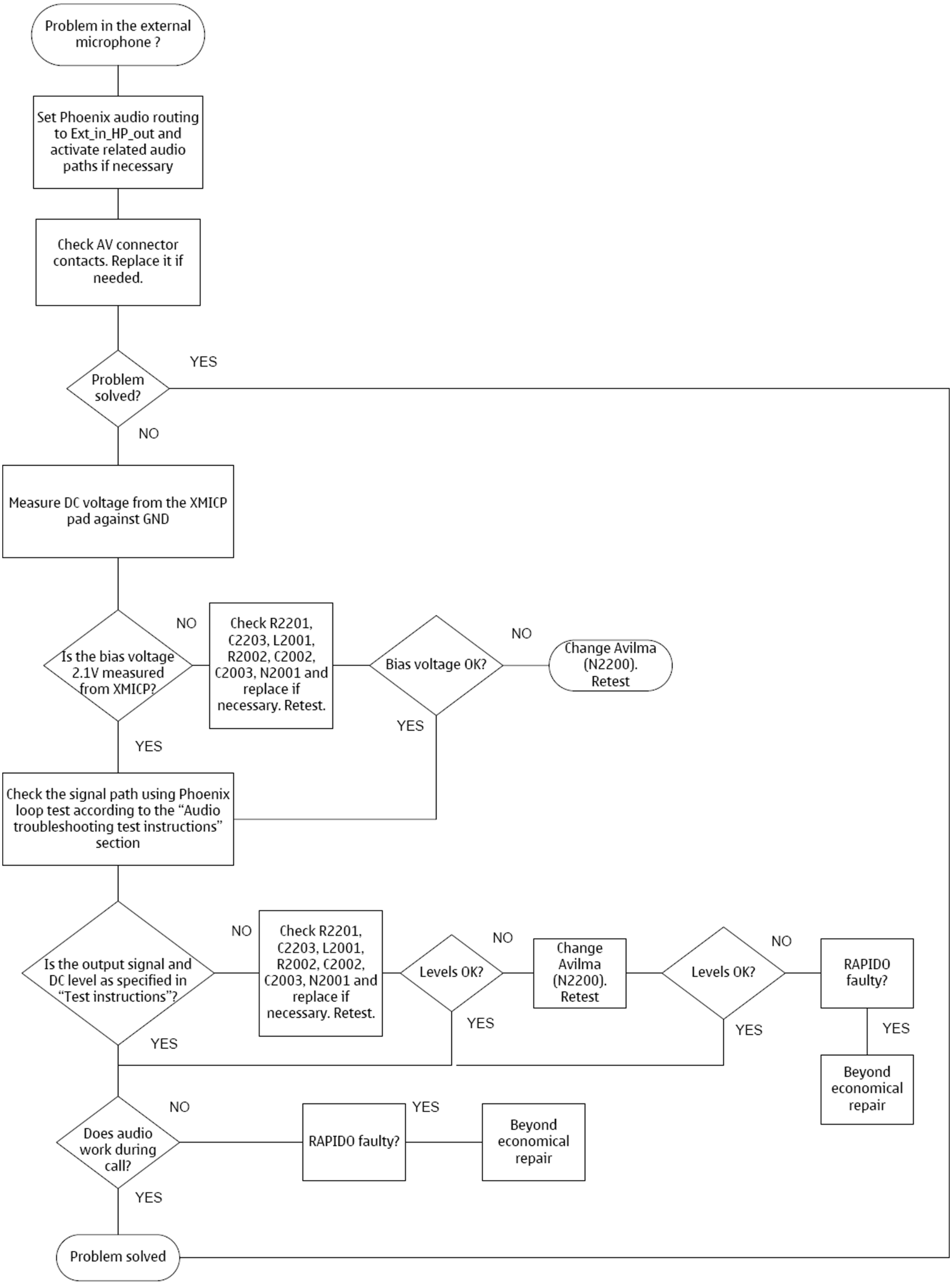
IHF speakers troubleshooting

Troubleshooting flow


Problem in the internal handsfree speakers?
Set Phoenix audio routing to Ext_in IHF_out mode and activate related audio paths if necessary
Check the speaker modules and PWB connections
Problem solved
YES
NO
Check the signal path using Phoenix test loop testing according to the "Audio troubleshooting test instructions" section
Is the output signal level as specified in "Test instructions"
NO
YES
Check L2102, L2103, R2106, R2107, C2105, C2106, C2107, L2101, L2104, and replace if necessary. Retest.
Levels OK?
NO
YES
Change Avilma (N2200). Retest.
Levels OK?
NO
YES
RAPIDO faulty
YES
Beyond economical repair
Does audio work during a call
NO
RAPIDO faulty
YES
Beyond economical repair
YES
Problem solved

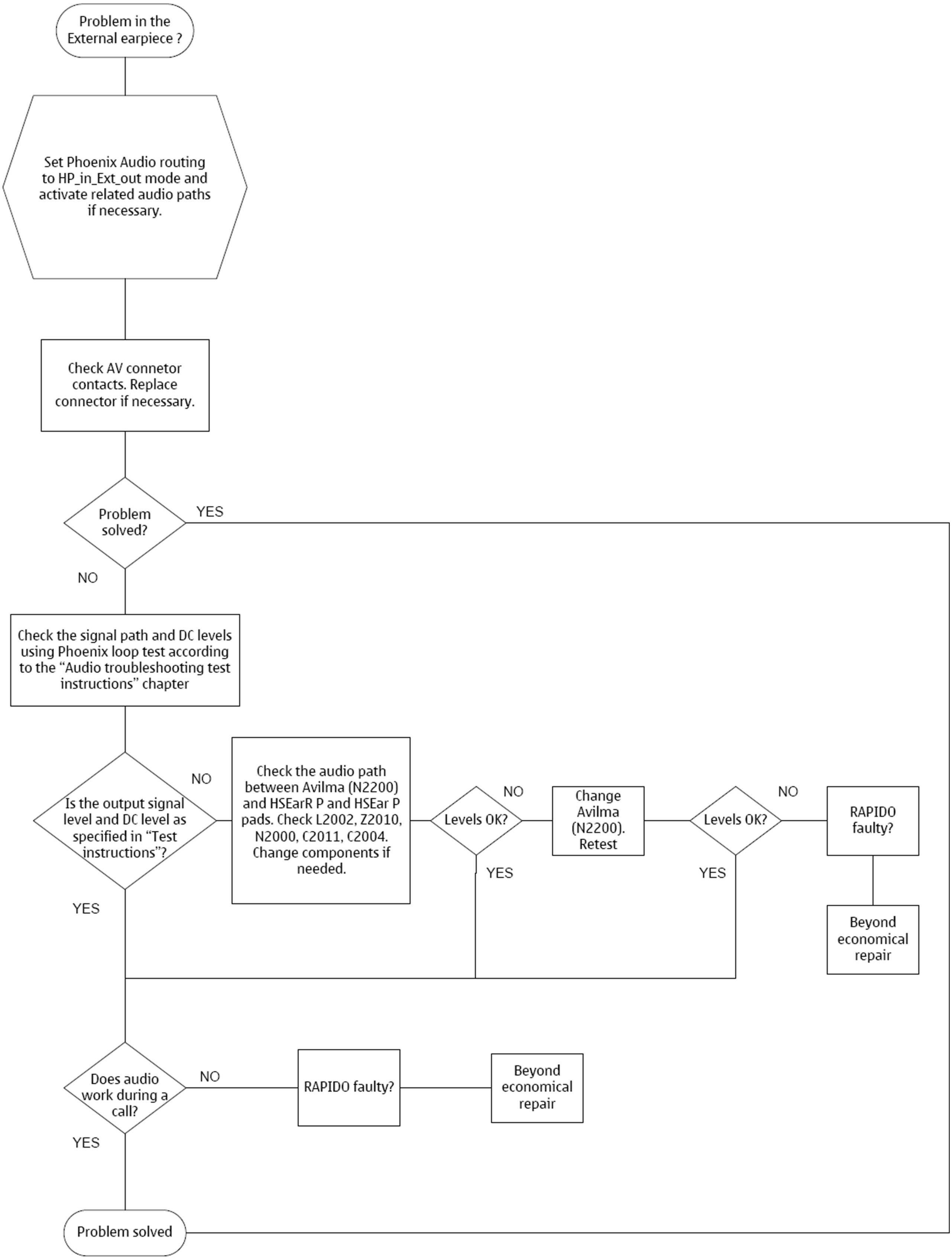
External headset microphone troubleshooting

Troubleshooting flow


Problem in the external microphone ?
Set Phoenix audio routing to Ext_in_HP_out and activate related audio paths if necessary
Check AV connector contacts. Replace it if needed.
Problem solved?
YES
NO
Measure DC voltage from the XMICP pad against GND
Is the bias voltage 2.1V measured from XMICP?
NO
Check R2201, C2203, L2001, R2002, C2002, C2003, N2001 and replace if necessary. Retest.
Bias voltage OK?
NO
Change Avilma (N2200). Retest
YES
YES
Check the signal path using Phoenix loop test according to the “Audio troubleshooting test instructions” section
Is the output signal and DC level as specified in “Test instructions”?
NO
Check R2201, C2203, L2001, R2002, C2002, C2003, N2001 and replace if necessary. Retest.
Levels OK?
NO
Change Avilma (N2200). Retest
Levels OK?
NO
RAPIDO faulty?
YES
YES
YES
Beyond economical repair
YES
Does audio work during call?
NO
RAPIDO faulty?
YES
Beyond economical repair
YES
Problem solved

External headset earpiece troubleshooting

Troubleshooting flow


Problem in the External earpiece ?
Set Phoenix Audio routing to HP_in_Ext_out mode and activate related audio paths if necessary.
Check AV connetor contacts. Replace connector if necessary.
Problem solved?
YES
NO
Check the signal path and DC levels using Phoenix loop test according to the "Audio troubleshooting test instructions" chapter
Is the output signal level and DC level as specified in "Test instructions"?
NO
YES
Check the audio path between Avilma (N2200) and HSEarR P and HSEar P pads. Check L2002, Z2010, N2000, C2011, C2004. Change components if needed.
Levels OK?
NO
YES
Change Avilma (N2200). Retest
Levels OK?
NO
YES
RAPIDO faulty?
Beyond economical repair
Does audio work during a call?
NO
YES
RAPIDO faulty?
Beyond economical repair
Problem solved

Acoustics troubleshooting

Introduction to acoustics troubleshooting

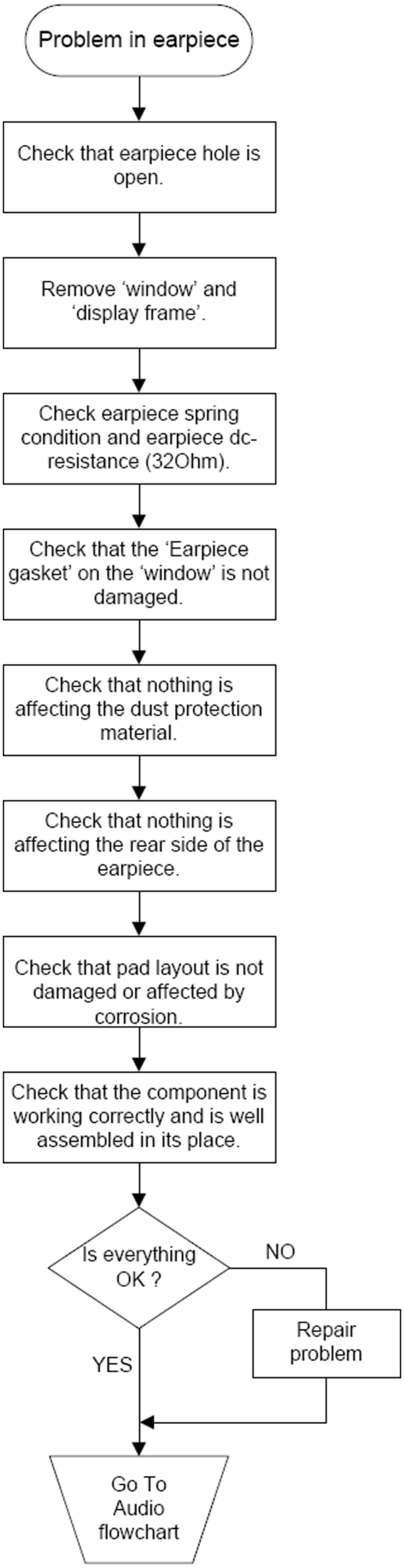
Acoustics design ensures that the sound is detected correctly with a microphone and properly radiated to the outside of the device by the speaker. The acoustics of the phone includes three basic systems: earpiece, Integrated Hands Free (IHF) and microphone.

The sound reproduced from the earpiece readiates through a single hole on the front cover (A-cover). The sound reproduced from the IHF speaker radiates from the sound holes located on the left side of the device. Microphone is located at the bottom, next to the system connector.

For a correct functionality of the phone, all sound holes must be always open. When the phone is used, care must be taken not to close any of those holes with a hand or fingers. The phone should be dry and clean, and no objects must be located in such a way that they close any of the holes.

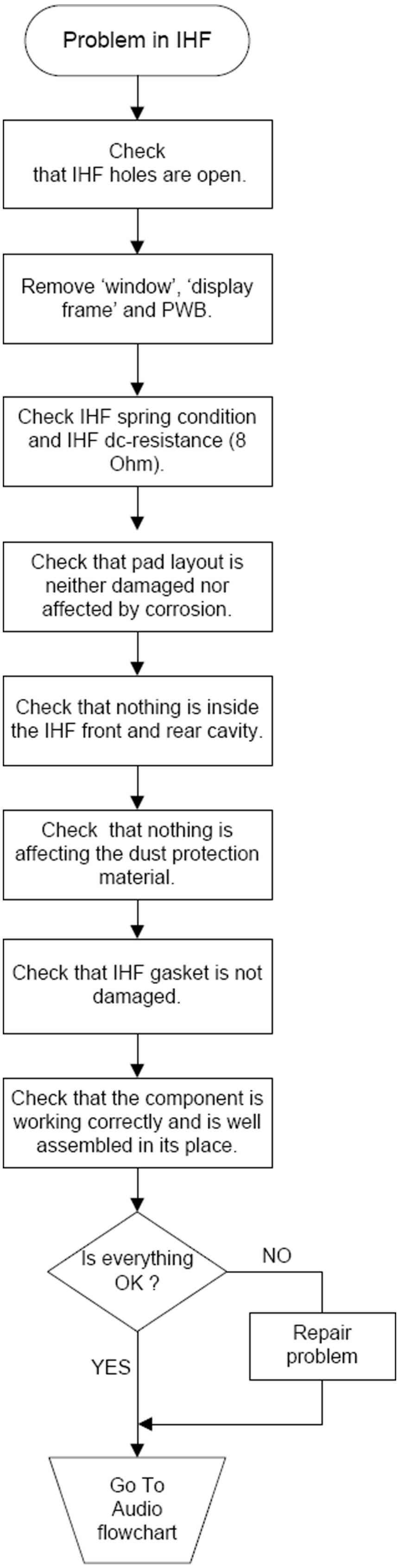
Earpiece troubleshooting

Troubleshooting flow


Problem in earpiece
Check that earpiece hole is open.
Remove 'window' and 'display frame'.
Check earpiece spring condition and earpiece dc-resistance (32Ohm).
Check that the 'Earpiece gasket' on the 'window' is not damaged.
Check that nothing is affecting the dust protection material.
Check that nothing is affecting the rear side of the earpiece.
Check that pad layout is not damaged or affected by corrosion.
Check that the component is working correctly and is well assembled in its place.
Is everything OK ?
NO
Repair problem
YES
Go To Audio flowchart

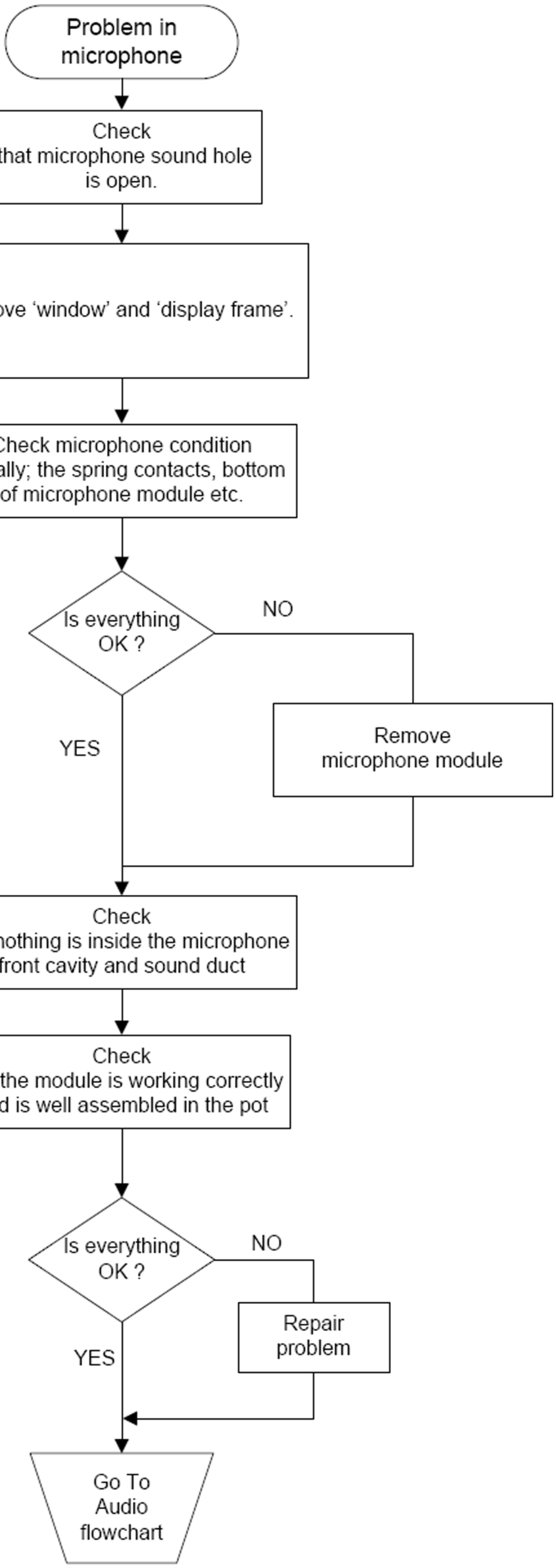
IHF troubleshooting

Troubleshooting flow


Problem in IHF
Check that IHF holes are open.
Remove 'window', 'display frame' and PWB.
Check IHF spring condition and IHF dc-resistance (8 Ohm).
Check that pad layout is neither damaged nor affected by corrosion.
Check that nothing is inside the IHF front and rear cavity.
Check that nothing is affecting the dust protection material.
Check that IHF gasket is not damaged.
Check that the component is working correctly and is well assembled in its place.
Is everything OK ?
NO
Repair problem
YES
Go To Audio flowchart

Microphone troubleshooting

Troubleshooting flow


Problem in microphone
Check that microphone sound hole is open.
Remove ‘window’ and ‘display frame’.
Check microphone condition visually; the spring contacts, bottom of microphone module etc.
Is everything OK ?
NO
Remove microphone module
YES
Check that nothing is inside the microphone front cavity and sound duct
Check that the module is working correctly and is well assembled in the pot
Is everything OK ?
NO
Repair problem
YES
Go To Audio flowchart

Baseband manual tuning guide

Certificate restoring

Context

This procedure is performed when the device certificate is corrupted for some reason.

All tunings (RF & Baseband, UI) must be done after performing the certificate restoring procedure.

The procedure for certificate restoring is the following:

- Flash the phone with the latest available software using FPS-8 or FPS-10.

  Note: USB flashing does not work for a dead BB5 phone.
- Execute the certificate restore process in Phoenix.
- Tune the phone completely.

  Note: SX-4 smart card is needed.
- If the phone resets after certificate restoring, reflash the phone again.

Required equipment and setup:

- *Phoenix* service software v 2007.12.6 or newer.
- The latest phone model specific *Phoenix* data package.
- PKD-1 dongle
- SX-4 smart card (Enables testing and tuning features)
- External smart card reader

  Note: The smart card reader is only needed when FPS-8 is used. FPS-10 has an integrated smart card reader.
- Activated FPS-8 flash prommer **OR** FPS-10 flash prommer
- Latest flash update package for FPS-8 or FPS-10 flash prommers
- CU-4 control unit
- USB cable from PC USB Port to CU-4 control unit
- Phone model specific adapter for CU-4 control unit
- PCS-1 cable to power CU-4 from external power supply
- XCS-4 modular cable between flash prommer and CU-4

  Note: CU-4 must be supplied with +12 V from an external power supply in all steps of certificate restoring.

Steps

1. Program the phone software.
2. Execute the certificate restore process in Phoenix.

Next actions

After a successful rewrite, you must retune the phone completely by using *Phoenix* tuning functions.

Important: Perform all tunings: RF, BB, and UI.

Energy management calibration

Prerequisites

Energy Management (EM) calibration is performed to calibrate the setting (gain and offset) of AD converters in several channels (that is, **battery voltage**, **BSI**, **battery current**) to get an accurate AD conversion result.

Hardware setup:

- An external power supply is needed.
- Supply 12V DC from an external power supply to CU-4 to power up the phone.
- The phone must be connected to a CU-4 control unit with a product-specific flash adapter.

Steps

1. Place the phone to the docking station adapter (CU-4 is connected to the adapter).
2. Start *Phoenix* service software.
3. Choose **File**→ **Scan Product.**
4. Choose **Tuning**→**Energy Management Calibration.**
5. To show the current values in the phone memory, click **Read**, and check that communication between the phone and CU-4 works.
6. Check that the **CU-4 used** check box is checked.
7. Select the item(s) to be calibrated.

   Note: ADC calibration has to be performed before other item(s). However, if all calibrations are selected at the same time, there is no need to perform the ADC calibration first.
8. Click **Calibrate**.

   The calibration of the selected item(s) is carried out automatically.

   The candidates for the new calibration values are shown in the *Calculated values* column. If the new calibration values seem to be acceptable (please refer to the following "Calibration value limits" table), click **Write** to store the new calibration values to the phone permanent memory.

Table 11 Calibration value limits

Parameter	Min.	Max.
ADC Offset	-20	20
ADC Gain	12000	14000
BSI Gain	1100	1300
VBAT Offset	2400	2650
VBAT Gain	19000	23000
VCHAR Gain	N/A	N/A
IBAT (ICal) Gain	7750	12250

9. Click **Read**, and confirm that the new calibration values are stored in the phone memory correctly. If the values are not stored to the phone memory, click **Write** and/or repeat the procedure again.
10. To end the procedure, close the *Energy Management Calibration* window.

4 — RF troubleshooting

(This page left intentionally blank.)

Table of Contents

General RF troubleshooting 4–5
Introduction to RF troubleshooting 4–5
RF key components 4–6
Non-replaceable RF components....4–7
General voltage checking 4–8
Phoenix self tests 4–9
VCTCXO troubleshooting 4–11
Receiver troubleshooting 4–12
Introduction to receiver (RX) troubleshooting.... 4–12
RX GSM850 troubleshooting.... 4–13
RX GSM900 troubleshooting.... 4–14
RX GSM1800 troubleshooting.... 4–15
RX GSM1900 troubleshooting.... 4–16
GSM RX chain activation for manual measurements/GSM RSSI measurement 4–17
WCDMA receiver troubleshooting 4–18
WCDMA RX chain activation for manual measurement 4–19
WCDMA RSSI measurement 4–20
Transmitter troubleshooting 4–20
General instructions for transmitter (TX) troubleshooting.... 4–20
GSM transmitter troubleshooting 4–21
TX 850/900 troubleshooting.... 4–23
TX 1800/1900 troubleshooting.... 4–24
Checking antenna functionality.... 4–25
WCDMA transmitter troubleshooting 4–27
WCDMA transmitter troubleshooting flowchart.... 4–29
RF tunings 4–29
Introduction to RF tunings 4–29
Autotuning for BB5 4–30
System mode independent manual tunings 4–31
RF channel filter calibration 4–31
PA (power amplifier) detection 4–31
GSM receiver tunings.... 4–32
Rx calibration (GSM) 4–32
Rx band filter response compensation (GSM).... 4–35
GSM transmitter tunings.... 4–38
Tx IQ tuning (GSM).... 4–38
Tx power level tuning (GSM) 4–40
WCDMA receiver tunings.... 4–43
RX calibration (WCDMA) 4–43
WCDMA transmitter tunings.... 4–45
Tx AGC & power detector (WCDMA).... 4–45
Tx band response calibration (WCDMA) 4–51
Tx LO leakage (WCDMA) 4–53

List of Tables

Table 12 Rf channel filter calibration tuning limits.... 4–31
Table 13 RF tuning limits in Rx calibration.... 4–34

List of Figures

Figure 19 RF key components - bottom 4–6
Figure 20 General voltage checking test points 4–9
Figure 21 WCDMA RX generator settings 4–20
Figure 22 Typical readings 4–22
Figure 23 Main antenna components 4–25
Figure 24 Antenna frame contacts 4–26
Figure 25 BT antenna location 4–26
Figure 26 BT antenna assembly components 4–27
Figure 27 Phoenix WCDMA TX control window 4–28
Figure 28 WCDMA power window 4–28
Figure 29 Auto tuning concept with CMU200 4–30
Figure 30 Rf channel filter calibration typical values 4–31
Figure 31 Pop-up window for WCDMA2100 4–43
Figure 32 Pop-up window for WCDMA2100 4–45
Figure 33 WCDMA power level tuning steps 4–47
Figure 34 High burst measurement 4–49

General RF troubleshooting

Introduction to RF troubleshooting

Most RF semiconductors are static discharge sensitive

ESD protection must be applied during repair (ground straps and ESD soldering irons).

Pre-baking

These parts are moisture sensitive and must be pre-baked prior to soldering:

- RFIC N7505
- Front End Module (FEM) N7520
- WCDMA PA N7540

Discrete components

In addition to the key-components, there are a number of discrete components (resistors, inductors and capacitors) for which troubleshooting is done mainly by *visual inspection*.

Capacitors: check for short circuits.

Resistors: check value with an ohm meter.

Note: In-circuit measurements should be evaluated carefully

Measuring equipment

All measurements should be done using:

- An oscilloscope for low frequency and DC measurements. Recommended probe: 10:1, 10Mohm//8pF.
- A radio communication tester including RF generator and spectrum analyser, for example Rohde & Schwarz CMU200. (Alternatively a spectrum analyser and an RF generator can be used. Some tests in this guide are not possible to perform if this solution is chosen).

Note: A mobile phone WCDMA transmitter should never be tested with full TX power (only it possible to perform the measurements in a good RF-shielded room). Even low power WCDMA transmitters may disturb nearby WCDMA networks and cause problems to 3G cellular phone communication in a wide area.

Note: All measurements with an RF coupler should be performed in an RF-shielded environment because nearby base stations can disturb sensitive receiver measurements. If there is no possibility to use RF shielded environment, testing at frequencies of nearby base stations should be avoided.

Level of repair

The scope of this guideline is to enable repairs at key-component level. Some key-components are not accessible without replacing the whole shield frame (i.e. not replaceable). Please refer to the list of Non-replaceable RF components (page 4–7).

RF key components

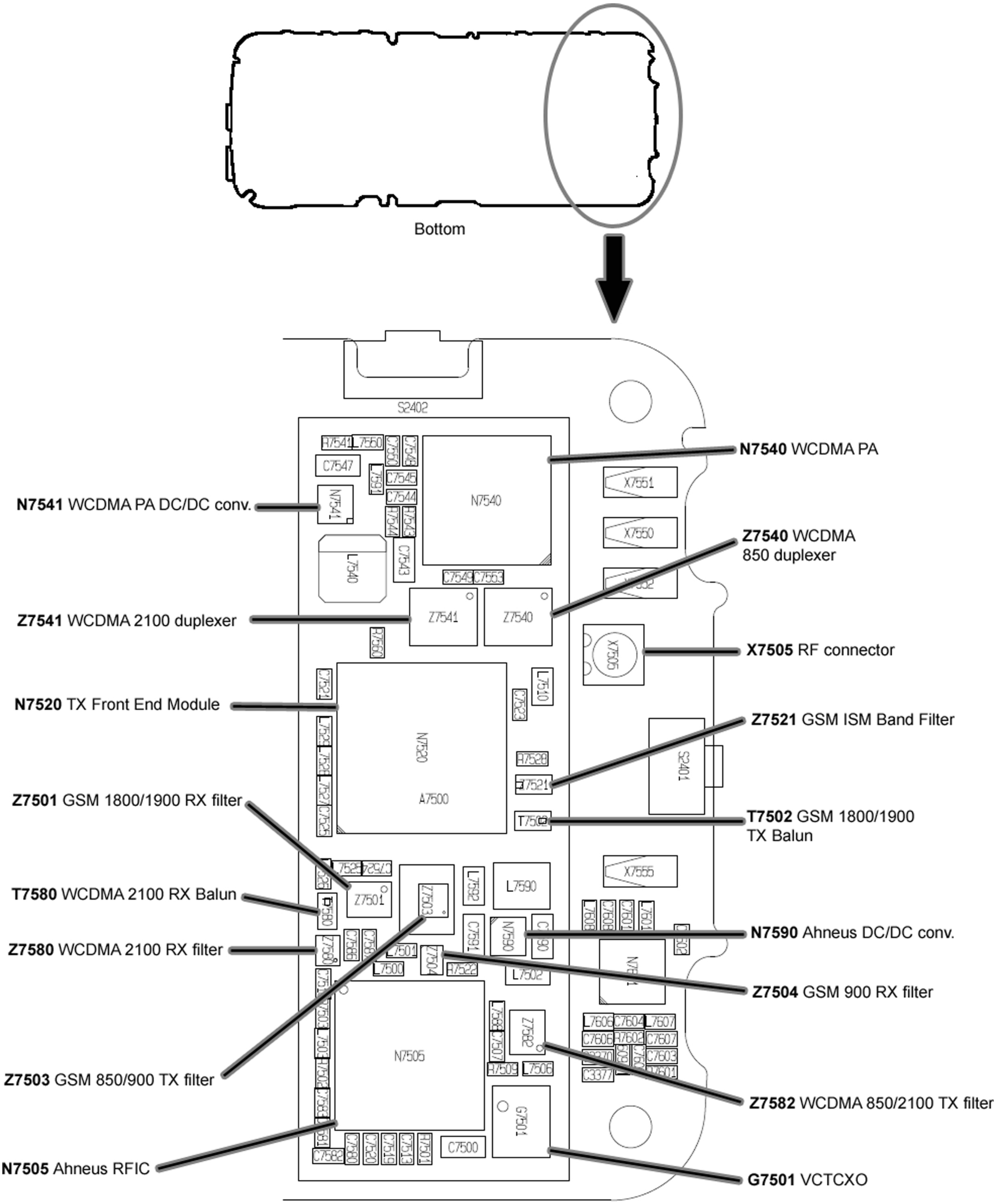
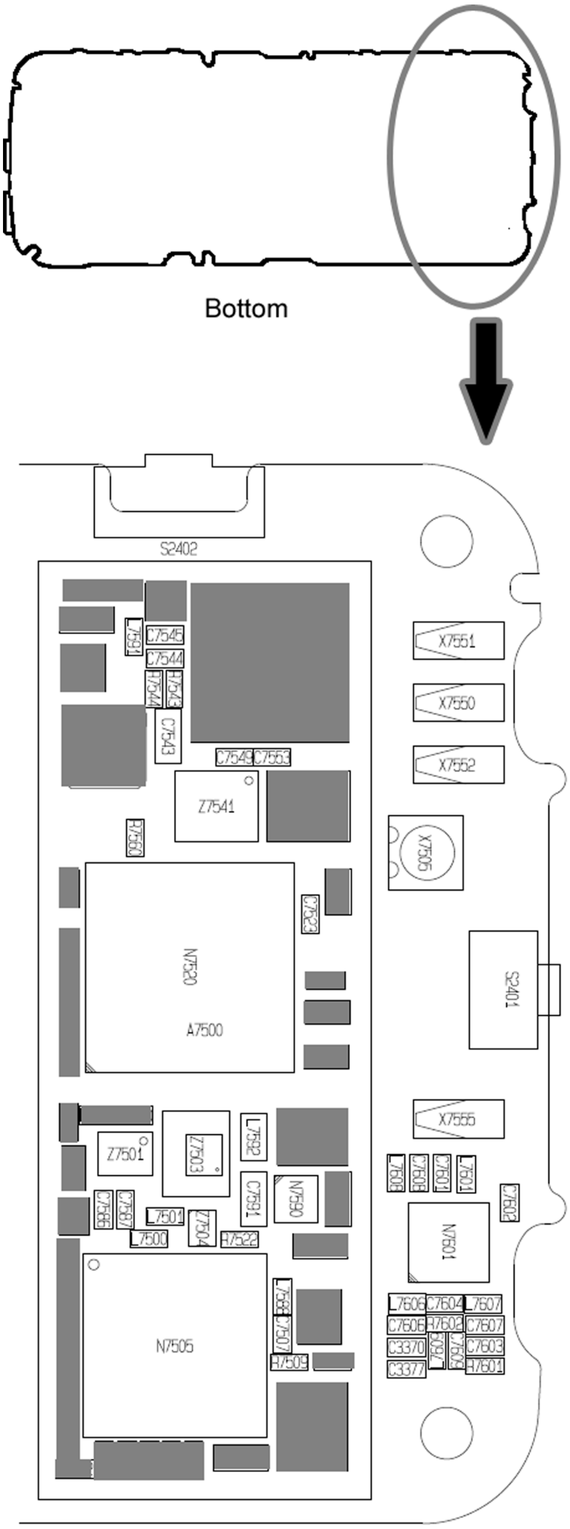

Bottom
S2402
N7540 WCDMA PA
N7541 WCDMA PA DC/DC conv.
Z7540 WCDMA 850 duplexer
Z7541 WCDMA 2100 duplexer
X7505 RF connector
N7520 TX Front End Module
Z7521 GSM ISM Band Filter
Z7501 GSM 1800/1900 RX filter
T7502 GSM 1800/1900 TX Balun
T7580 WCDMA 2100 RX Balun
Z7580 WCDMA 2100 RX filter
N7590 Ahneus DC/DC conv.
Z7504 GSM 900 RX filter
Z7503 GSM 850/900 TX filter
Z7582 WCDMA 850/2100 TX filter
N7505 Ahneus RFIC
G7501 VCTCXO
N7540
N7541
L7540
Z7541
Z7540
X7551
X7550
X7505
N7520
A7500
S2401
X7555
Z7501
Z7503
L7590
N7590
N7505
G7501
C7500

Figure 19 RF key components - bottom

Non-replaceable RF components

Because of their location on the PWB, the following RF components cannot be replaced without replacing the whole shield frame:


Bottom
S2402
C7545
C7544
C7543
C7549
C7553
X7551
X7550
X7552
Z7541
X7505
N7520
A7500
S2401
X7555
Z7501
Z7503
L7592
C7591
N7590
L7501
L7500
R7522
N7601
N7505
R7509
C3370
C3377

Non-replaceable RF components

C7500
C7513
C7518
C7519
C7520
C7521
C7524
C7525
C7547
C7548
C7550
C7580
C7581
C7582
C7583
C7590
G7501
L7502
L7503
L7506
L7510
L7525
L7526
L7527
L7528
L7529
L7540
L7550
L7590
N7540
N7541
R7501
R7502
R7503
R7528
R7541
T7502
T7580
Z7521
Z7540
Z7580
Z7582

Note! The RF components listed above can be replaced only by replacing the whole shield frame.

General voltage checking

Steps

1. Set up the main board in the module jig. The phone should be in local mode.
2. Check the following:

#	Signal name	Test point	Voltage (all bands)
1	VCTCXO supply	R7501	2.5 V
2	AHNEUS supply from DC/DC conv	C7590	3.2 V
3	FEM supply	L7510	3.9 V
4	WCDMA PA supply from DC/DC conv	C7543	0 V (1.3 V* when transmitting. Settings as in note below)
5	Vbat at WCDMA PA	C7547	3.9 V
6	Supply input to DC/DC conv	L7592	3.9 V

* With these settings, the result should be 1.3 V.

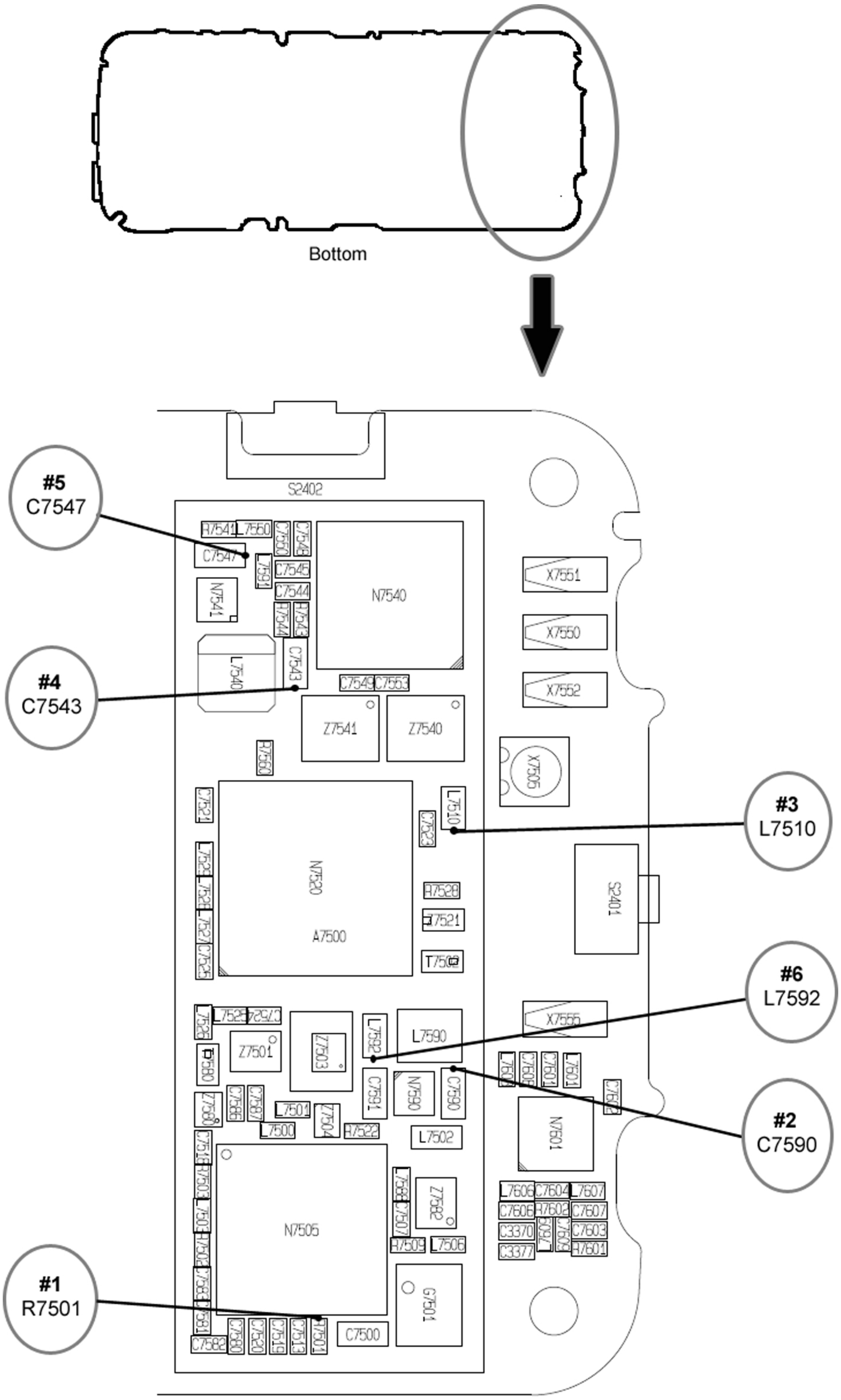

Bottom
#5
C7547
#4
C7543
#3
L7510
#6
L7592
#2
C7590
#1
R7501
S2402
N7540
X7551
X7550
X7552
Z7541
Z7540
N7520
A7500
S2401
X7555
L7590
Z7501
Z7503
N7590
N7601
N7505
G7501
C7500
L7502

Figure 20 General voltage checking test points

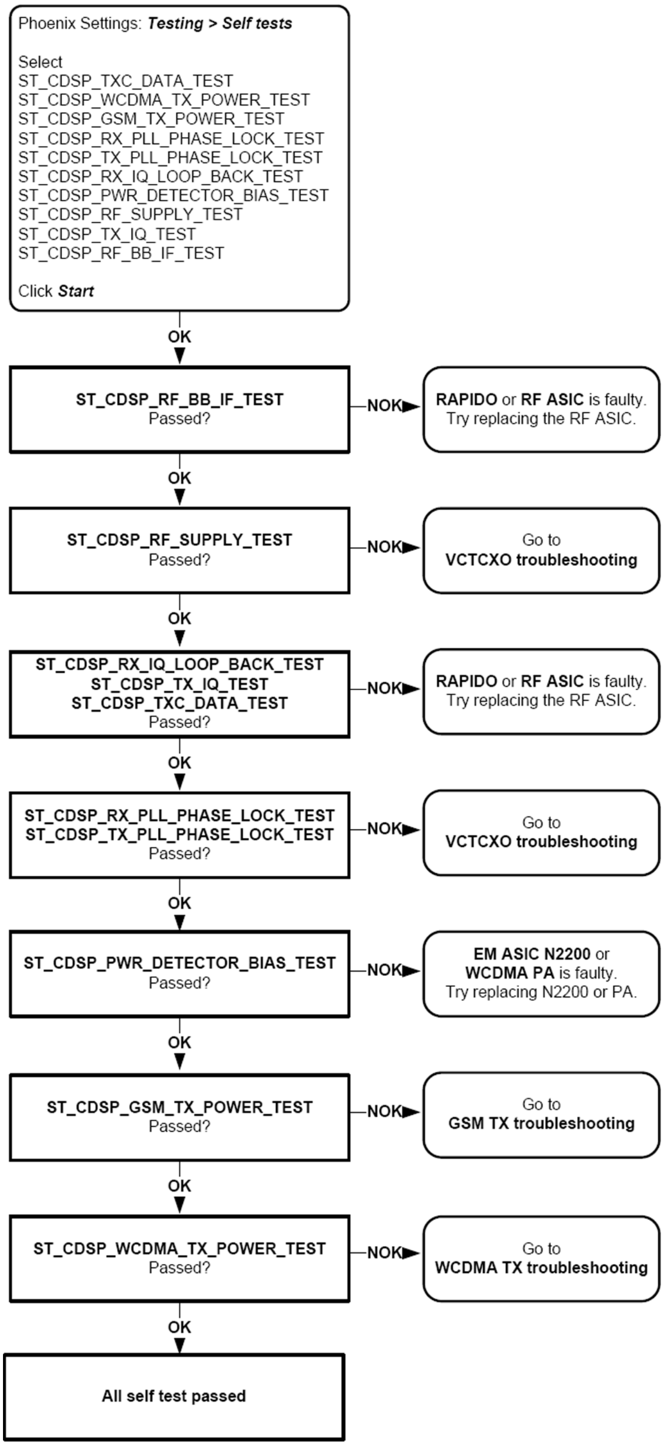
Phoenix self tests

Context

Always start the troubleshooting procedure by running the Phoenix self tests. If a test fails, please follow the diagram below.

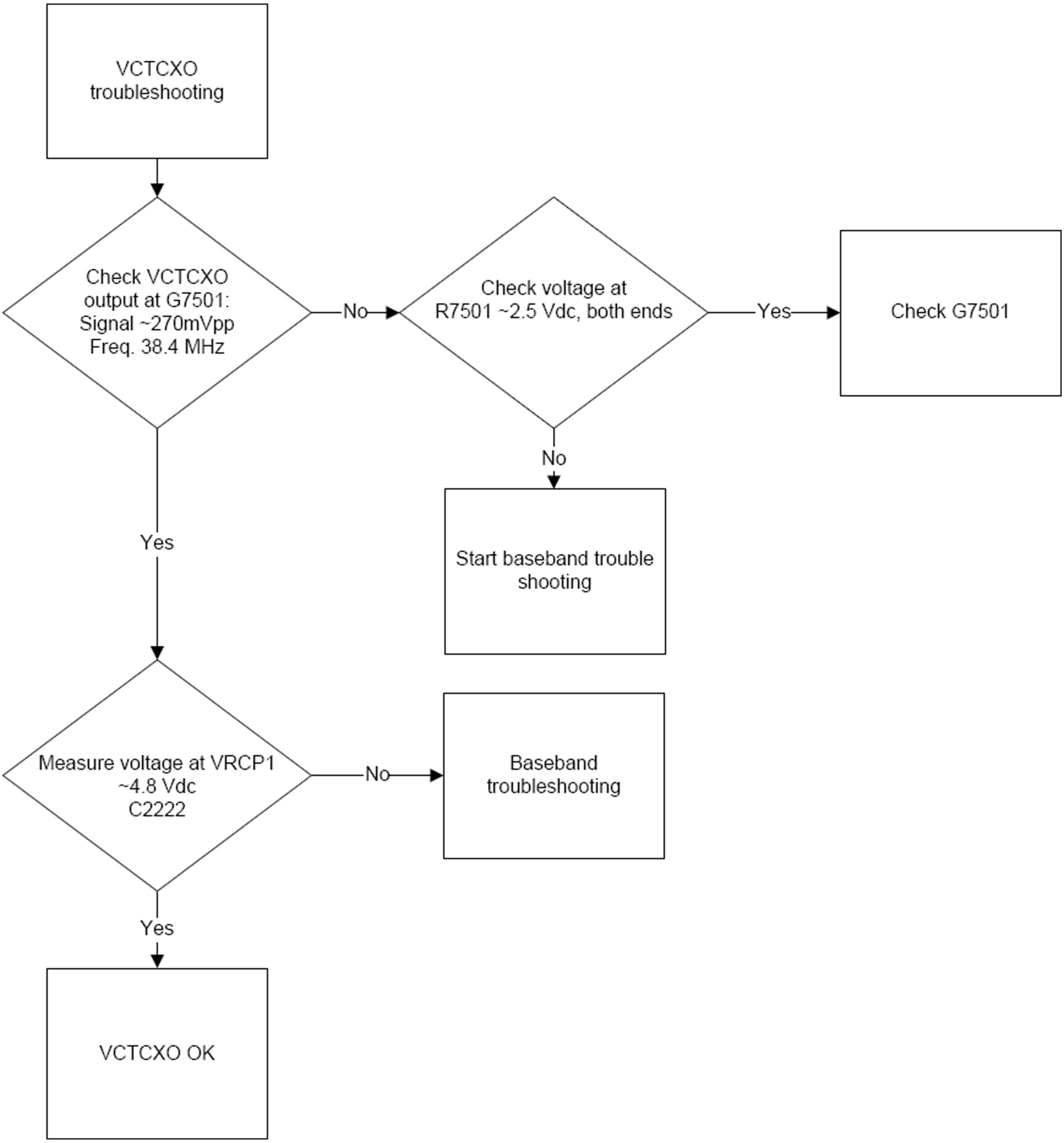
If the phone is dead and you cannot perform the self tests, go to *Dead or jammed device troubleshooting.* in the baseband troubleshooting section.

Troubleshooting flow


Phoenix Settings: ***Testing > Self tests***
Select
ST_CDSP_TXC_DATA_TEST
ST_CDSP_WCDMA_TX_POWER_TEST
ST_CDSP_GSM_TX_POWER_TEST
ST_CDSP_RX_PLL_PHASE_LOCK_TEST
ST_CDSP_TX_PLL_PHASE_LOCK_TEST
ST_CDSP_RX_IQ_LOOP_BACK_TEST
ST_CDSP_PWR_DETECTOR_BIAS_TEST
ST_CDSP_RF_SUPPLY_TEST
ST_CDSP_TX_IQ_TEST
ST_CDSP_RF_BB_IF_TEST
Click *Start*
OK
ST_CDSP_RF_BB_IF_TEST
Passed?
NOK
RAPIDO or **RF ASIC** is faulty.
Try replacing the RF ASIC.
OK
ST_CDSP_RF_SUPPLY_TEST
Passed?
NOK
Go to
VCTCXO troubleshooting
OK
ST_CDSP_RX_IQ_LOOP_BACK_TEST
ST_CDSP_TX_IQ_TEST
ST_CDSP_TXC_DATA_TEST
Passed?
NOK
RAPIDO or **RF ASIC** is faulty.
Try replacing the RF ASIC.
OK
ST_CDSP_RX_PLL_PHASE_LOCK_TEST
ST_CDSP_TX_PLL_PHASE_LOCK_TEST
Passed?
NOK
Go to
VCTCXO troubleshooting
OK
ST_CDSP_PWR_DETECTOR_BIAS_TEST
Passed?
NOK
EM ASIC N2200 or
WCDMA PA is faulty.
Try replacing N2200 or PA.
OK
ST_CDSP_GSM_TX_POWER_TEST
Passed?
NOK
Go to
GSM TX troubleshooting
OK
ST_CDSP_WCDMA_TX_POWER_TEST
Passed?
NOK
Go to
WCDMA TX troubleshooting
OK
All self test passed

VCTCXO troubleshooting

Troubleshooting flow


VCTCXO troubleshooting
Check VCTCXO output at G7501: Signal ~270mVpp Freq. 38.4 MHz
No
Check voltage at R7501 ~2.5 Vdc, both ends
Yes
Check G7501
No
Start baseband trouble shooting
Yes
Measure voltage at VRCP1 ~4.8 Vdc C2222
No
Baseband troubleshooting
Yes
VCTCXO OK

■ Receiver troubleshooting

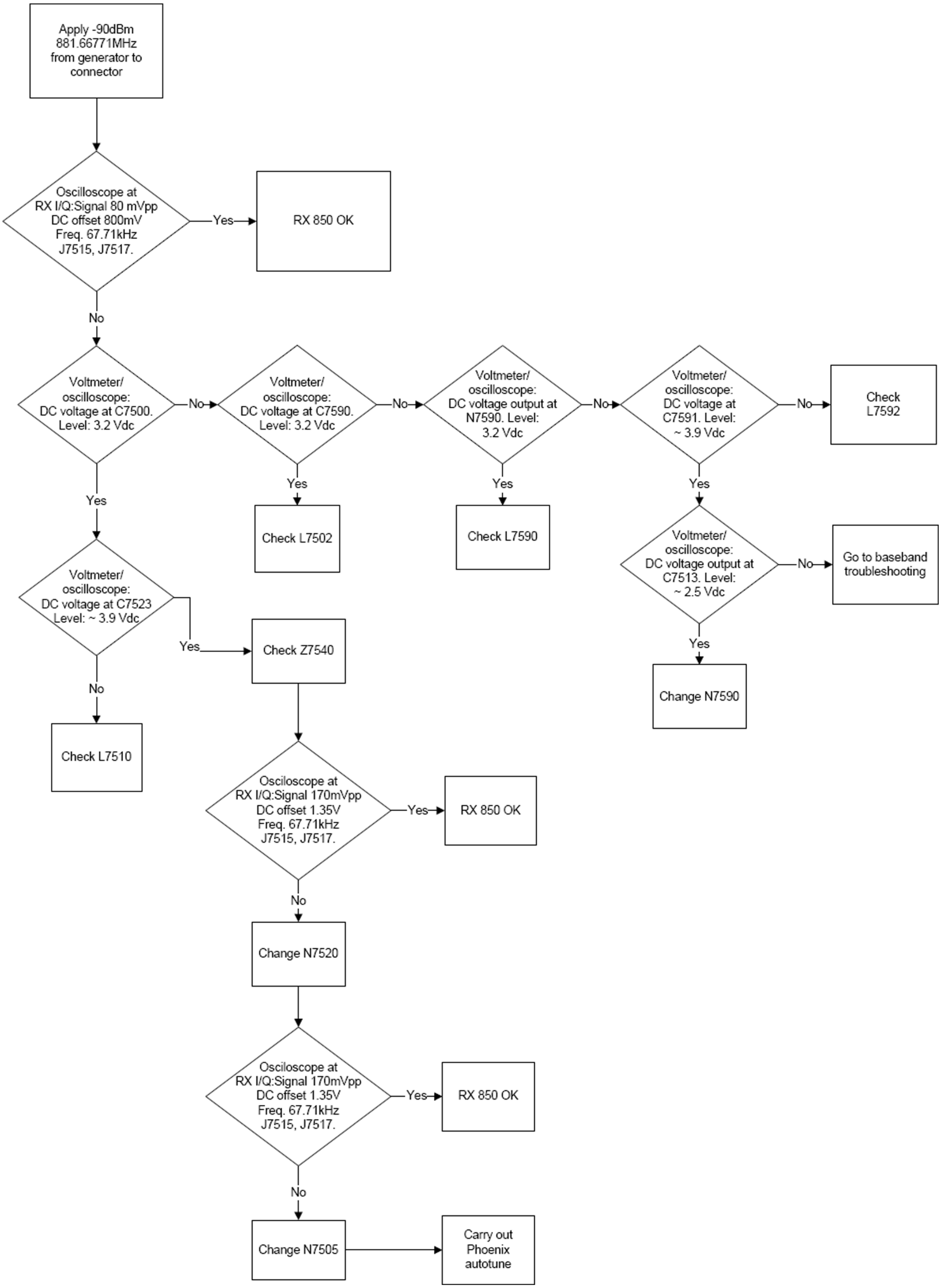
Introduction to receiver (RX) troubleshooting

RX can be tested by making a phone call or in local mode. For the local mode testing, use Phoenix service software.

The main RX troubleshooting measurement is RSSI reading. This test measures the signal strength of the received signal. For GSM RSSI measurements, see GSM RX chain activation for manual measurements / GSM RSSI measurement (page 4–17). For a similar test in WCDMA mode, see WCDMA RSSI measurement (page 4–20).

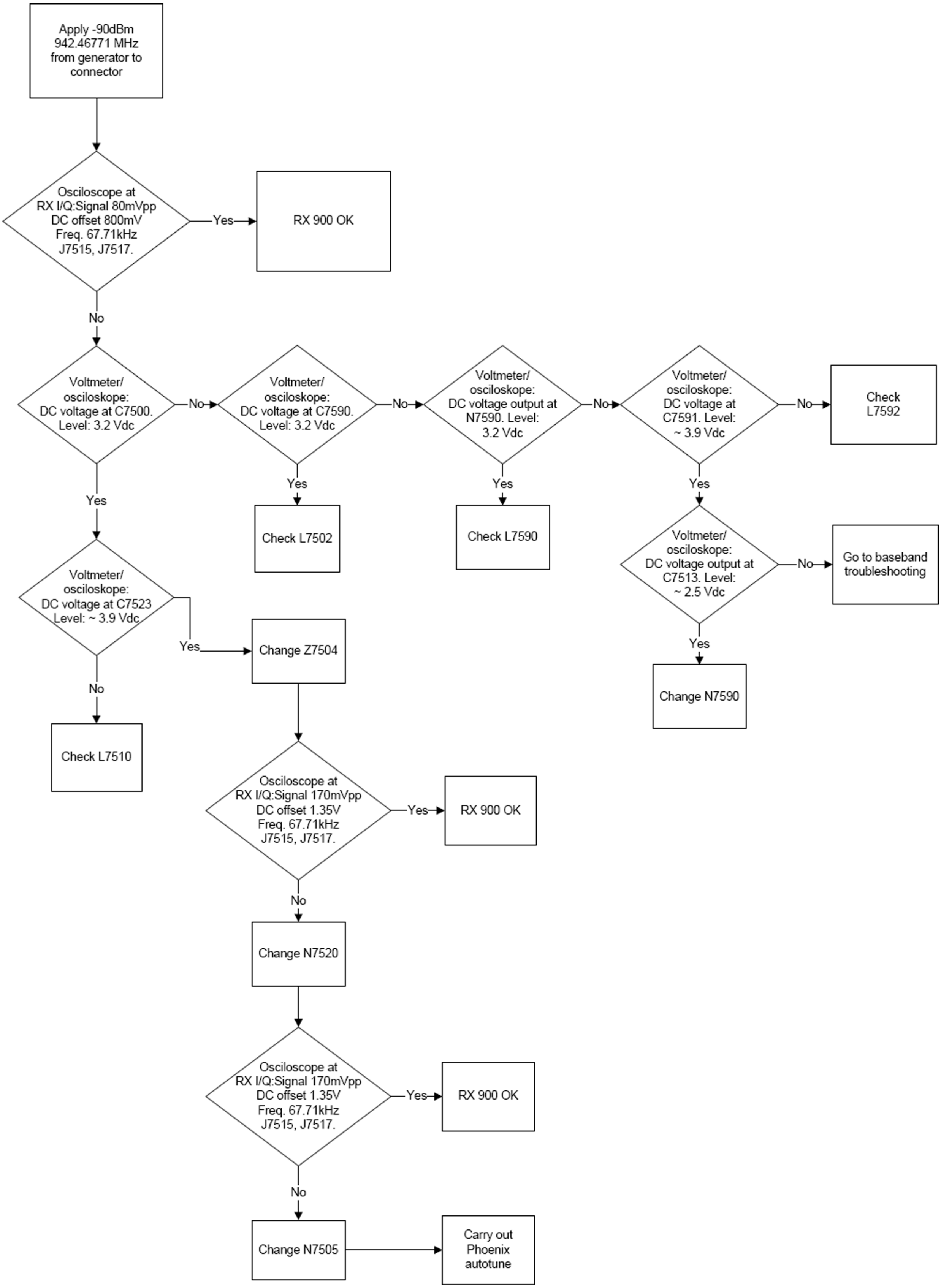
RX GSM850 troubleshooting

Troubleshooting flow


Apply -90dBm 881.66771MHz from generator to connector
Oscilloscope at RX I/Q:Signal 80 mVpp DC offset 800mV Freq. 67.71kHz J7515, J7517.
Yes
RX 850 OK
No
Voltmeter/ oscilloscope: DC voltage at C7500. Level: 3.2 Vdc
No
Voltmeter/ oscilloscope: DC voltage at C7590. Level: 3.2 Vdc
No
Voltmeter/ oscilloscope: DC voltage output at N7590. Level: 3.2 Vdc
No
Voltmeter/ oscilloscope: DC voltage at C7591. Level: ~ 3.9 Vdc
No
Check L7592
Yes
Check L7502
Yes
Check L7590
Yes
Voltmeter/ oscilloscope: DC voltage output at C7513. Level: ~ 2.5 Vdc
No
Go to baseband troubleshooting
Yes
Change N7590
Yes
Voltmeter/ oscilloscope: DC voltage at C7523 Level: ~ 3.9 Vdc
Yes
Check Z7540
No
Check L7510
Osciloscope at RX I/Q:Signal 170mVpp DC offset 1.35V Freq. 67.71kHz J7515, J7517.
Yes
RX 850 OK
No
Change N7520
Osciloscope at RX I/Q:Signal 170mVpp DC offset 1.35V Freq. 67.71kHz J7515, J7517.
Yes
RX 850 OK
No
Change N7505
Carry out Phoenix autotune

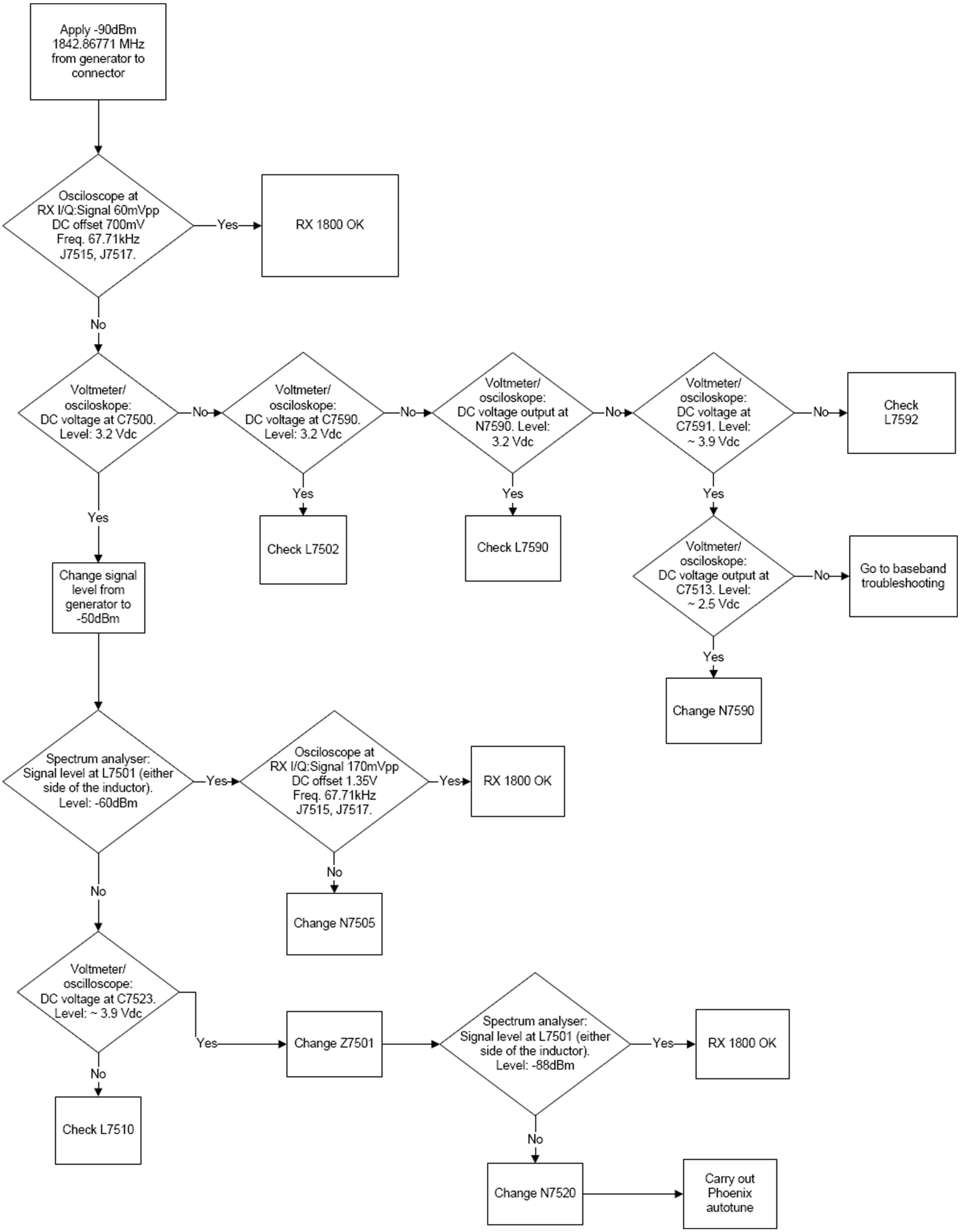
RX GSM900 troubleshooting

Troubleshooting flow


Apply -90dBm 942.46771 MHz from generator to connector
Osciloscope at RX I/Q:Signal 80mVpp DC offset 800mV Freq. 67.71kHz J7515, J7517.
Yes
RX 900 OK
No
Voltmeter/ osciloskope: DC voltage at C7500. Level: 3.2 Vdc
No
Voltmeter/ osciloskope: DC voltage at C7590. Level: 3.2 Vdc
No
Voltmeter/ osciloskope: DC voltage output at N7590. Level: 3.2 Vdc
No
Voltmeter/ osciloskope: DC voltage at C7591. Level: ~ 3.9 Vdc
No
Check L7592
Yes
Check L7502
Yes
Check L7590
Yes
Voltmeter/ osciloskope: DC voltage output at C7513. Level: ~ 2.5 Vdc
No
Go to baseband troubleshooting
Yes
Change N7590
Yes
Voltmeter/ osciloskope: DC voltage at C7523 Level: ~ 3.9 Vdc
Yes
Change Z7504
No
Check L7510
Osciloscope at RX I/Q:Signal 170mVpp DC offset 1.35V Freq. 67.71kHz J7515, J7517.
Yes
RX 900 OK
No
Change N7520
Osciloscope at RX I/Q:Signal 170mVpp DC offset 1.35V Freq. 67.71kHz J7515, J7517.
Yes
RX 900 OK
No
Change N7505
Carry out Phoenix autotune

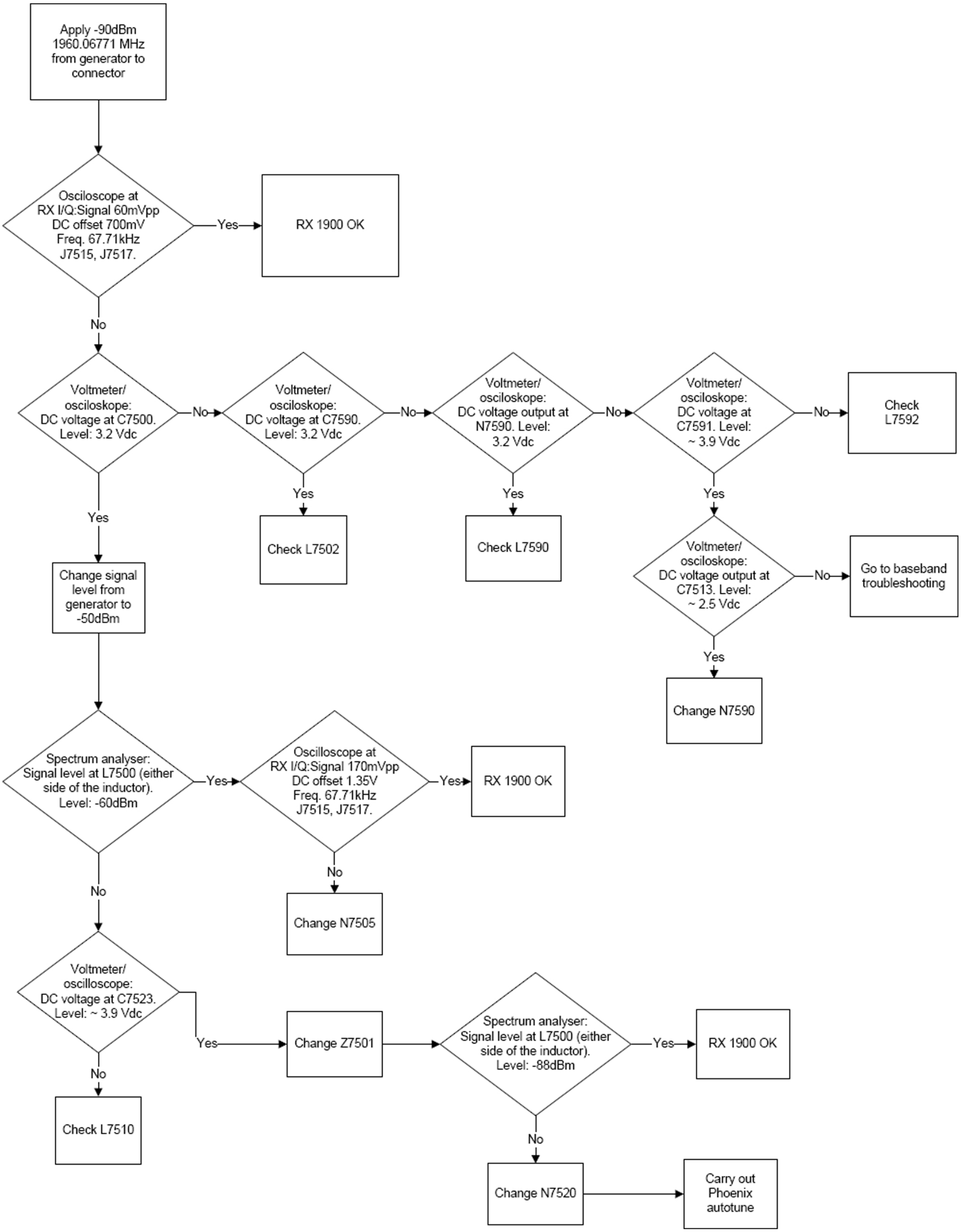
RX GSM1800 troubleshooting

Troubleshooting flow


Apply -90dBm 1842.86771 MHz from generator to connector
Oscilloscope at RX I/Q:Signal 60mVpp DC offset 700mV Freq. 67.71kHz J7515, J7517.
Yes
RX 1800 OK
No
Voltmeter/ osciloskope: DC voltage at C7500. Level: 3.2 Vdc
No
Voltmeter/ osciloskope: DC voltage at C7590. Level: 3.2 Vdc
No
Voltmeter/ osciloskope: DC voltage output at N7590. Level: 3.2 Vdc
No
Voltmeter/ osciloskope: DC voltage at C7591. Level: ~ 3.9 Vdc
No
Check L7592
Yes
Check L7502
Yes
Check L7590
Yes
Voltmeter/ osciloskope: DC voltage output at C7513. Level: ~ 2.5 Vdc
No
Go to baseband troubleshooting
Yes
Change N7590
Yes
Change signal level from generator to -50dBm
Spectrum analyser: Signal level at L7501 (either side of the inductor). Level: -60dBm
Yes
Oscilloscope at RX I/Q:Signal 170mVpp DC offset 1.35V Freq. 67.71kHz J7515, J7517.
Yes
RX 1800 OK
No
Change N7505
No
Voltmeter/ oscilloscope: DC voltage at C7523. Level: ~ 3.9 Vdc
Yes
Change Z7501
Spectrum analyser: Signal level at L7501 (either side of the inductor). Level: -88dBm
Yes
RX 1800 OK
No
Check L7510
No
Change N7520
Carry out Phoenix autotune

RX GSM1900 troubleshooting

Troubleshooting flow


Apply -90dBm 1960.06771 MHz from generator to connector
Oscilloscope at RX I/Q:Signal 60mVpp DC offset 700mV Freq. 67.71kHz J7515, J7517.
Yes
RX 1900 OK
No
Voltmeter/ osciloskope: DC voltage at C7500. Level: 3.2 Vdc
No
Voltmeter/ osciloskope: DC voltage at C7590. Level: 3.2 Vdc
No
Voltmeter/ osciloskope: DC voltage output at N7590. Level: 3.2 Vdc
No
Voltmeter/ osciloskope: DC voltage at C7591. Level: ~ 3.9 Vdc
No
Check L7592
Yes
Check L7502
Yes
Check L7590
Yes
Voltmeter/ osciloskope: DC voltage output at C7513. Level: ~ 2.5 Vdc
No
Go to baseband troubleshooting
Yes
Change N7590
Yes
Change signal level from generator to -50dBm
Spectrum analyser: Signal level at L7500 (either side of the inductor). Level: -60dBm
Yes
Oscilloscope at RX I/Q:Signal 170mVpp DC offset 1.35V Freq. 67.71kHz J7515, J7517.
Yes
RX 1900 OK
No
Change N7505
No
Voltmeter/ oscilloscope: DC voltage at C7523. Level: ~ 3.9 Vdc
Yes
Change Z7501
Spectrum analyser: Signal level at L7500 (either side of the inductor). Level: -88dBm
Yes
RX 1900 OK
No
Check L7510
No
Change N7520
Carry out Phoenix autotune

GSM RX chain activation for manual measurements/GSM RSSI measurement

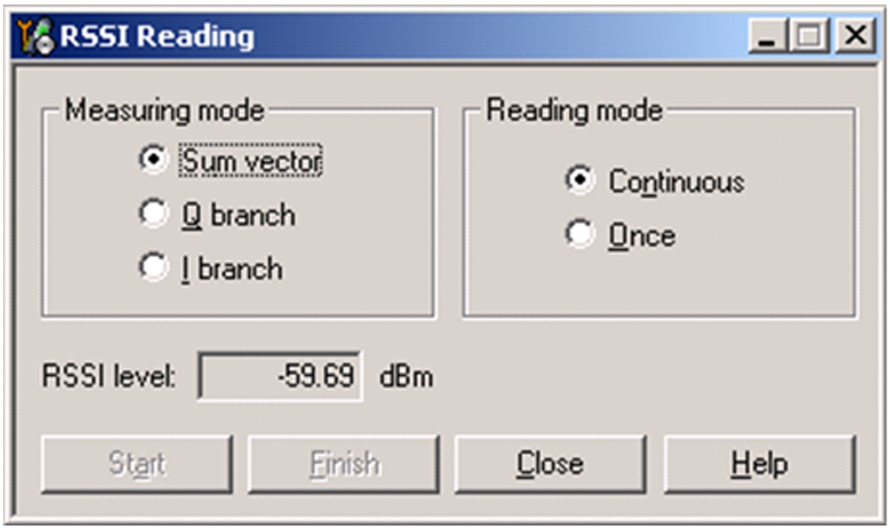
Prerequisites

Make the following settings in Phoenix service software:

Setting	GSM850	GSM900	GSM1800	GSM1900
Phoenix Channel	190	37	700	661
Signal generator to antenna connector	881.66771MHz (67.71kHz offset) at -60dBm	942.46771MHz (67.71kHz offset) at -60dBm	1842.86771MHz (67.71kHz offset) at -60dBm	1960.06771MHz (67.71kHz offset) at -60dBm

Steps

1. Set the phone to local mode.
2. Activate RSSI reading in Phoenix (**Testing→GSM→RSSI reading**)



Measuring mode
● Sum vector
○ Q branch
○ I branch

Reading mode
● Continuous
○ Once

RSSI level: -59.69 dBm

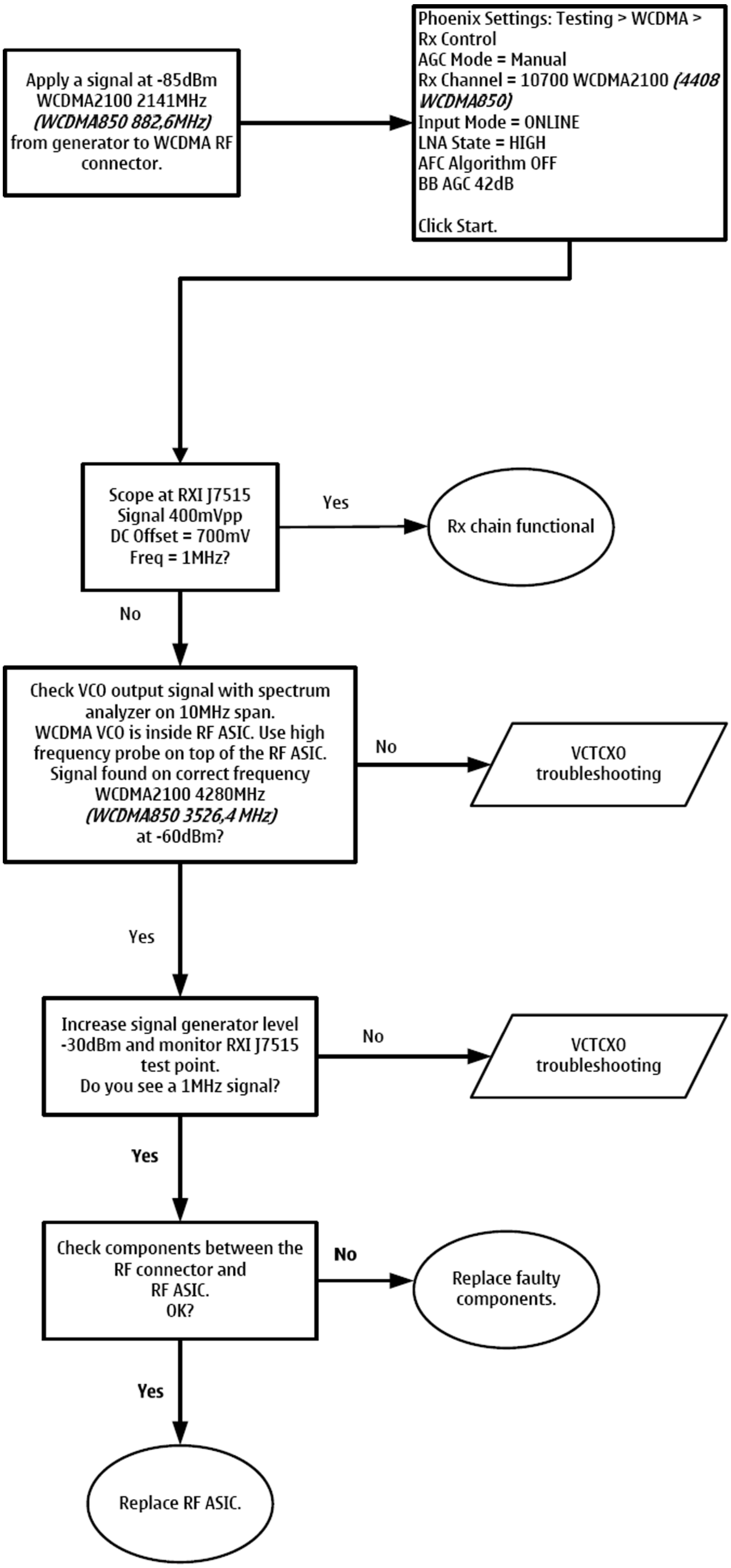
Results

The reading should reflect the level of the signal generator (-losses) +/- 5 dB.

When varying the level in the range -30 to -102 dBm the reading should then follow within +/-5 dB.

WCDMA receiver troubleshooting

Troubleshooting flow


Apply a signal at -85dBm
WCDMA2100 2141MHz
(WCDMA850 882,6MHz)
from generator to WCDMA RF connector.
Phoenix Settings: Testing > WCDMA > Rx Control
AGC Mode = Manual
Rx Channel = 10700 WCDMA2100 *(4408 WCDMA850)*
Input Mode = ONLINE
LNA State = HIGH
AFC Algorithm OFF
BB AGC 42dB
Click Start.
Scope at RXI J7515
Signal 400mVpp
DC Offset = 700mV
Freq = 1MHz?
Yes
Rx chain functional
No
Check VCO output signal with spectrum analyzer on 10MHz span.
WCDMA VCO is inside RF ASIC. Use high frequency probe on top of the RF ASIC.
Signal found on correct frequency
WCDMA2100 4280MHz
(WCDMA850 3526,4 MHz)
at -60dBm?
No
VCTCXO troubleshooting
Yes
Increase signal generator level -30dBm and monitor RXI J7515 test point.
Do you see a 1MHz signal?
No
VCTCXO troubleshooting
Yes
Check components between the RF connector and RF ASIC.
OK?
No
Replace faulty components.
Yes
Replace RF ASIC.

WCDMA RX chain activation for manual measurement

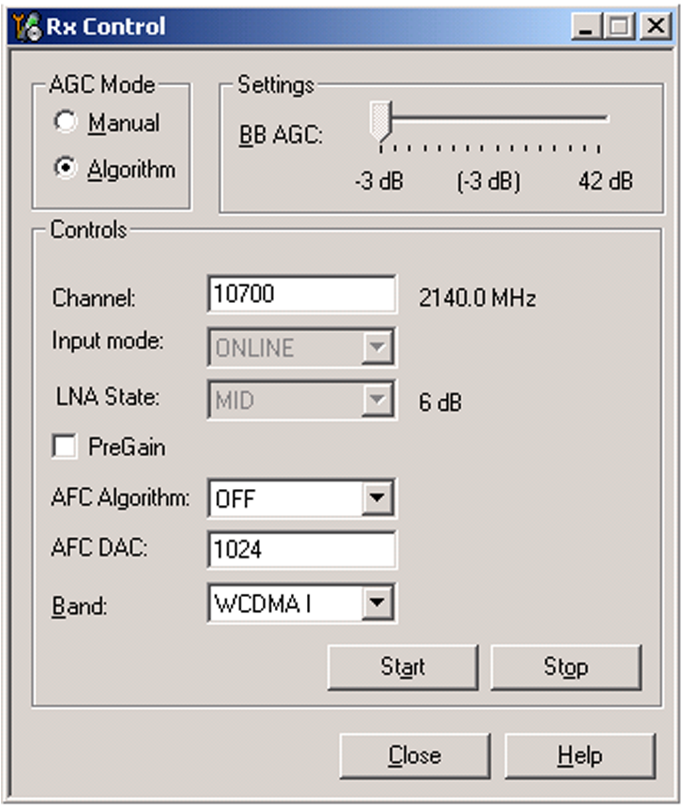
Prerequisites

Make the following settings in Phoenix service software:

Setting	WCDMA2100	WCDMA850
Phoenix Channel	10700	4408
Signal generator to antenna connector	2141.0 MHz	882.6 MHz
Band	I	V

Steps

1. Via Phoenix Testing menu, choose **WCDMA/RX Control**.
2. In the RX control window, make the following settings:



○ Manual
● Algorithm

BB AGC: -3 dB (-3 dB) 42 dB

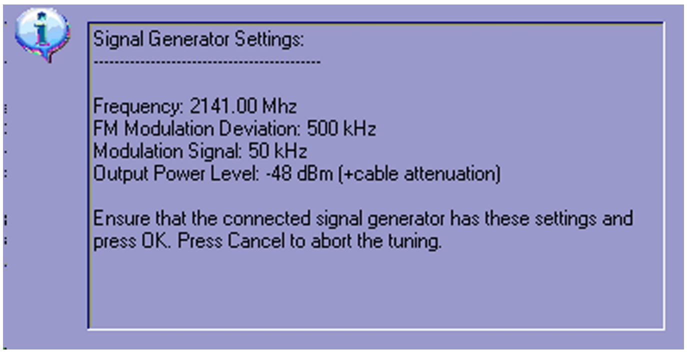
Channel: 10700 2140.0 MHz
Input mode: ONLINE
LNA State: MID 6 dB
☐ PreGain
AFC Algorithm: OFF
AFC DAC: 1024
Band: WCDMA I

3. Click **Start** to activate the settings.

   If the settings are changed later on (for example, change of channel) you have to click **Stop** and **Start** again.

   Note: Clicking **Stop** also disables TX control if it was active.

4. Set the following RF generator settings:



Signal Generator Settings:

Frequency: 2141.00 Mhz
FM Modulation Deviation: 500 kHz
Modulation Signal: 50 kHz
Output Power Level: -48 dBm (+cable attenuation)

Ensure that the connected signal generator has these settings and press OK. Press Cancel to abort the tuning.

Figure 21 WCDMA RX generator settings

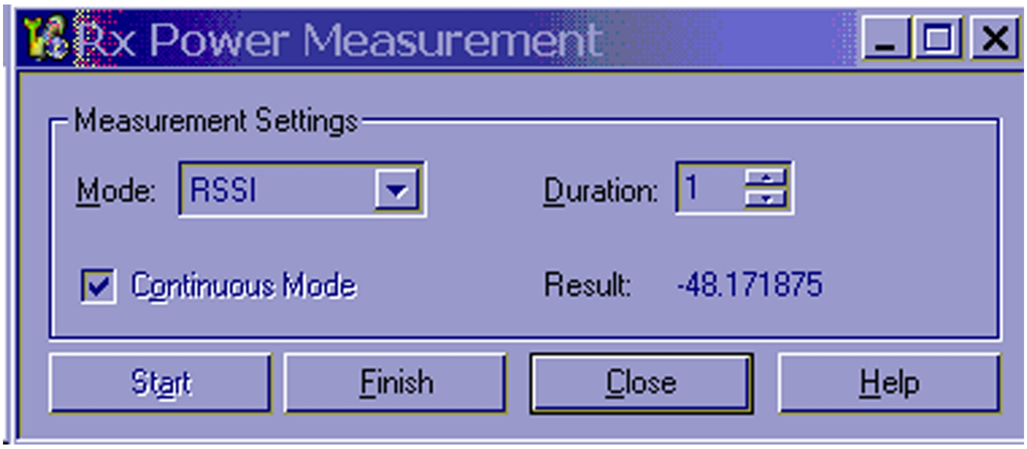
WCDMA RSSI measurement

Prerequisites

WCDMA RX must be activated before RSSI can be measured. For instructions, please refer to WCDMA RX chain activation (page).

Steps

1. From the Phoenix testing menu, select **WCDMA→RX Power measurement**
2. In the RX Power measurement window, select:
   - Mode: RSSI
   - Continuous mode



Mode: RSSI
Duration: 1
☑ Continuous Mode
Result: -48.171875

3. Click **Start** to perform the measurement.

Transmitter troubleshooting

General instructions for transmitter (TX) troubleshooting

Please note the following before performing transmitter tests:

- TX troubleshooting requires TX operation.
- Do not transmit on frequencies that are in use!
- The transmitter can be controlled in local mode for diagnostic purposes.
- The most useful Phoenix tool for GSM transmitter testing is “RF Controls”; in WCDMA transmitter testing the best tool is “TX Control”.
- Remember that re-tuning is not a fix! Phones are tuned correctly in production

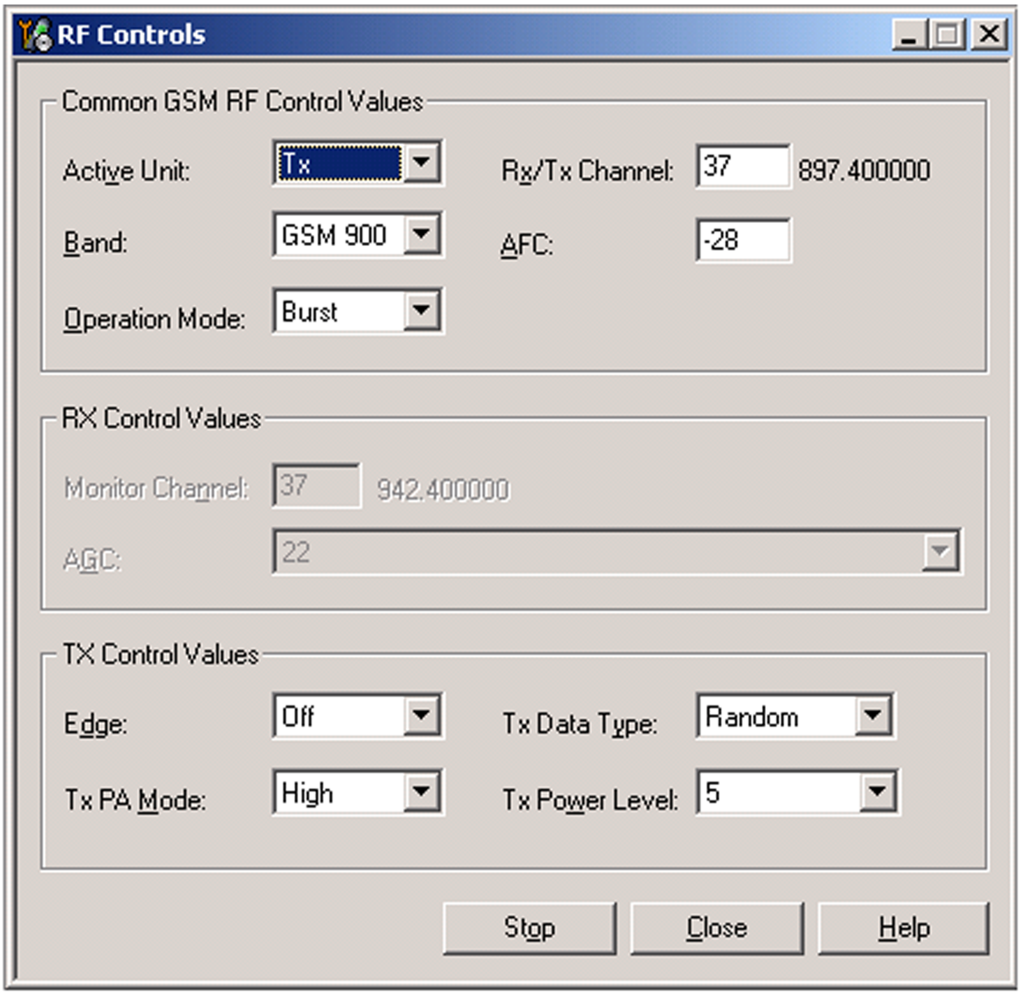
Note: Never activate the GSM or WCDMA transmitter without a proper antenna load. Always connect a 50 Ω load to the RF connector (antenna, RF-measurement equipment or at least a 2 W dummy load); otherwise the GSM or WCDMA Power amplifier (PA) may be damaged.

GSM transmitter troubleshooting

Steps

1. Set the phone to local mode.
2. Activate RF controls in Phoenix (**Testing→GSM→Rf Controls**).

   Use the following settings:



RF Controls

Common GSM RF Control Values

Active Unit: Tx

Band: GSM 900

Operation Mode: Burst

Rx/Tx Channel: 37 897.400000

AFC: -28

RX Control Values

Monitor Channel: 37 942.400000

AGC: 22

TX Control Values

Edge: Off

Tx PA Mode: High

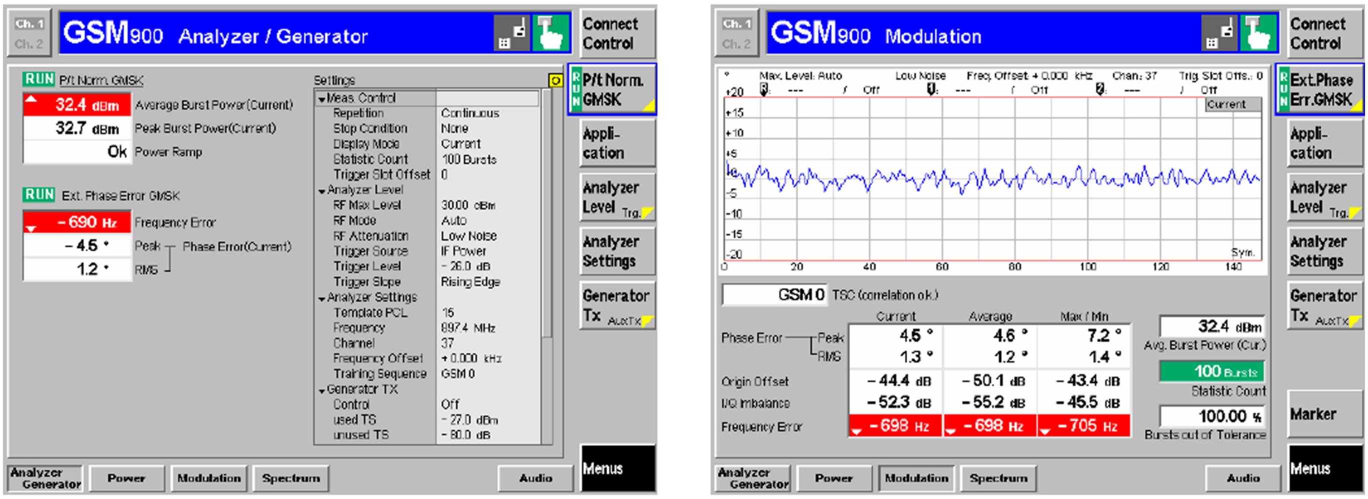
Tx Data Type: Random

Tx Power Level: 5

3. Check the basic TX parameters (i.e. power, phase error, modulation and switching spectrum), using a communication analyser (for example CMU200).

Analyser settings

Phase error


Ch. 1
Ch. 2
GSM900 Analyzer / Generator
GSM900 Modulation
Connect Control
P/t Norm. GMSK
Ext.Phase Err.GMSK
Appli-cation
Analyzer Level Trg.
Analyzer Settings
Generator Tx AuxTx
Marker
Menus
Analyzer Generator
Power
Modulation
Spectrum
Audio
Sym.

RUN P/t Norm. GMSK

32.4 dBm	Average Burst Power(Current)
32.7 dBm	Peak Burst Power(Current)
Ok	Power Ramp

RUN Ext. Phase Error GMSK

− 690 Hz	Frequency Error
− 4.5 °	Peak — Phase Error(Current)
1.2 °	RMS

Settings

Meas. Control	
Repetition	Continuous
Stop Condition	None
Display Mode	Current
Statistic Count	100 Bursts
Trigger Slot Offset	0
Analyzer Level	
RF Max Level	30.00 dBm
RF Mode	Auto
RF Attenuation	Low Noise
Trigger Source	IF Power
Trigger Level	− 26.0 dB
Trigger Slope	Rising Edge
Analyzer Settings	
Template PCL	15
Frequency	897.4 MHz
Channel	37
Frequency Offset	+ 0.000 kHz
Training Sequence	GSM 0
Generator TX	
Control	Off
used TS	− 27.0 dBm
unused TS	− 80.0 dB

Max. Level: Auto Low Noise Freq. Offset: + 0.000 kHz Chan.: 37 Trig. Slot Offs.: 0

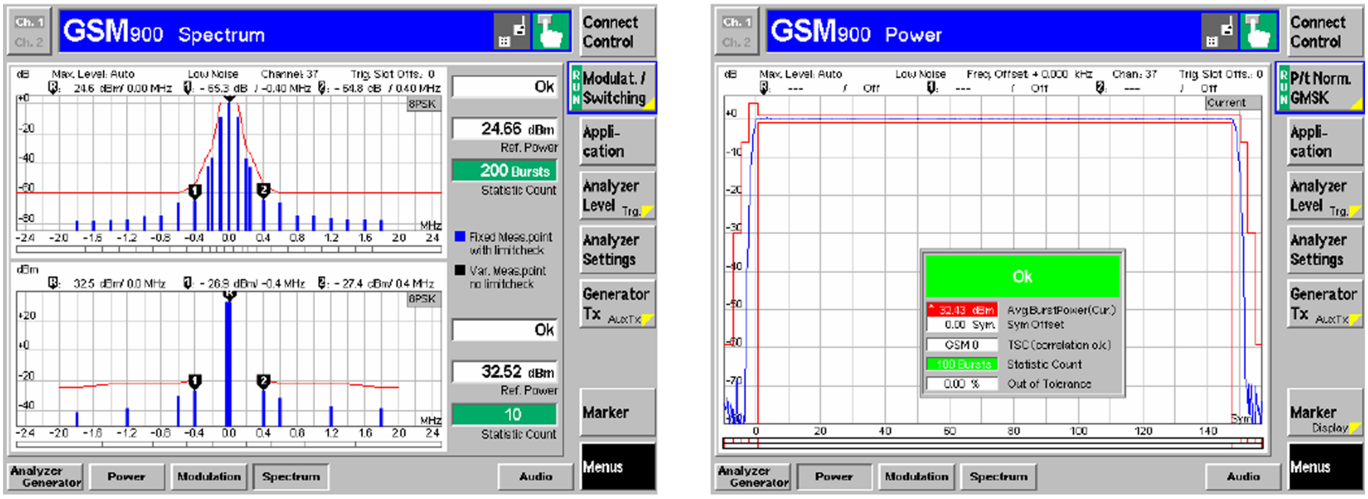
GSM 0 TSC (correlation o.k.)

	Current	Average	Max / Min
Phase Error Peak	4.5 °	4.6 °	7.2 °
Phase Error RMS	1.3 °	1.2 °	1.4 °
Origin Offset	− 44.4 dB	− 50.1 dB	− 43.4 dB
I/Q Imbalance	− 52.3 dB	− 55.2 dB	− 45.5 dB
Frequency Error	− 698 Hz	− 698 Hz	− 705 Hz

32.4 dBm	Avg. Burst Power (Cur.)
100 Bursts	Statistic Count
100.00 %	Bursts out of Tolerance

Modulation/Switching spectrum

Power/Burst


Ch. 1
Ch. 2
GSM900 Spectrum
GSM900 Power
Connect Control
Modulat. / Switching
P/t Norm. GMSK
Appli-cation
Analyzer Level Trg.
Analyzer Settings
Generator Tx AuxTx
Marker
Marker Display
Menus
Analyzer Generator
Power
Modulation
Spectrum
Audio
8PSK
MHz
Sym.

Max. Level: Auto Low Noise Channel: 37 Trig. Slot Offs.: 0

24.6 dBm/ 0.00 MHz − 65.3 dB / −0.40 MHz − 64.8 dB / 0.40 MHz

Ok	
24.66 dBm	Ref. Power
200 Bursts	Statistic Count

■ Fixed Meas.point with limitcheck

■ Var. Meas.point no limitcheck

32.5 dBm/ 0.0 MHz − 26.9 dBm/ −0.4 MHz − 27.4 dBm/ 0.4 MHz

Ok	
32.52 dBm	Ref. Power
10	Statistic Count

Max. Level: Auto Low Noise Freq. Offset: + 0.000 kHz Chan.: 37 Trig. Slot Offs.: 0

Ok

32.43 dBm	AvgBurstPower(Cur.)
0.00 Sym.	Sym.Offset
GSM 0	TSC (correlation o.k.)
100 Bursts	Statistic Count
0.00 %	Out of Tolerance

Figure 22 Typical readings

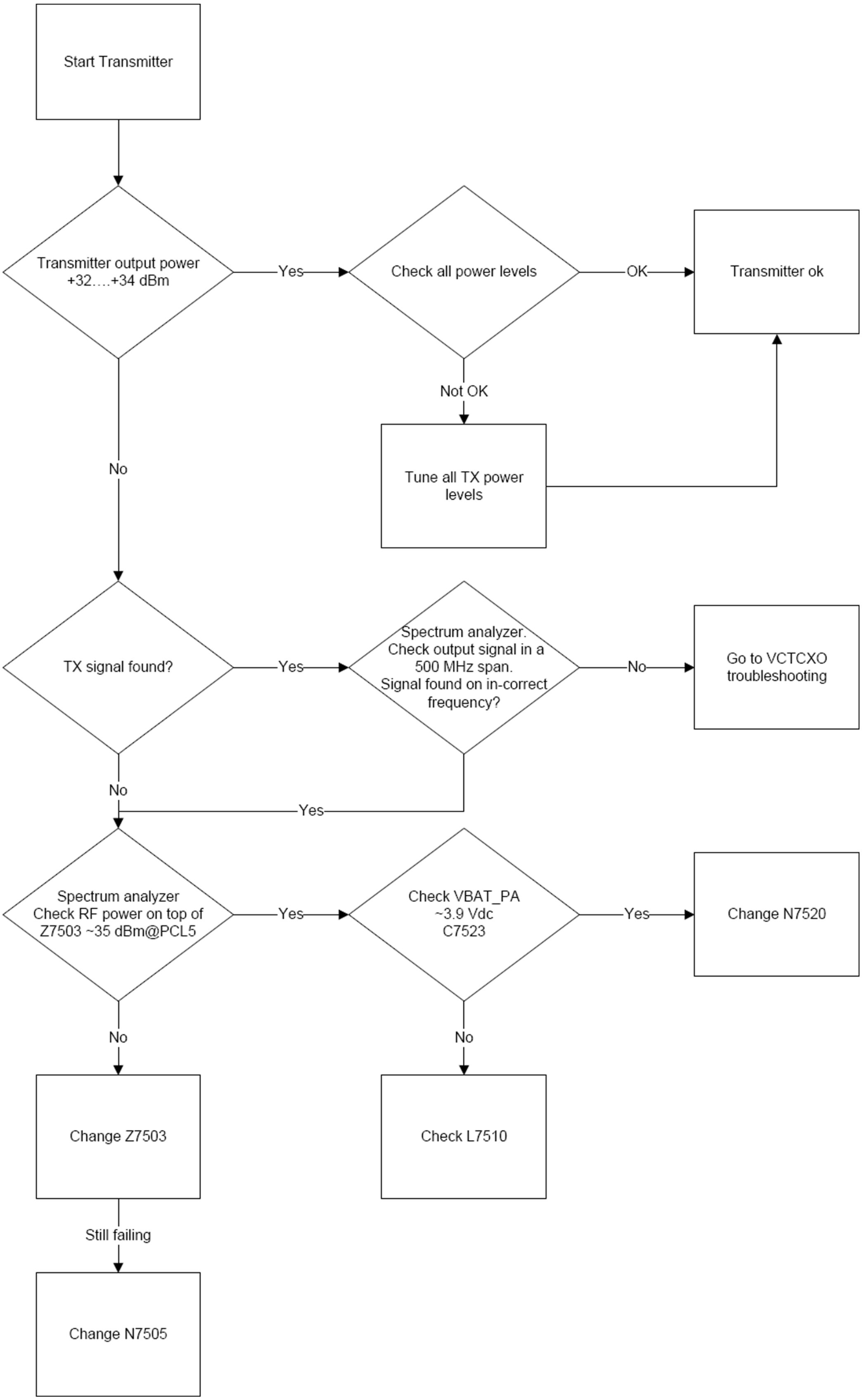
4. Change the power level (RF controls) and make sure the power reading follows accordingly.

Next actions

You can troubleshoot the GSM transmitter for each GSM band separately, one band at a time. If you want to troubleshoot GSM850, GSM1800 or GSM1900, change the band with the RF controls and set the communication analyser accordingly.

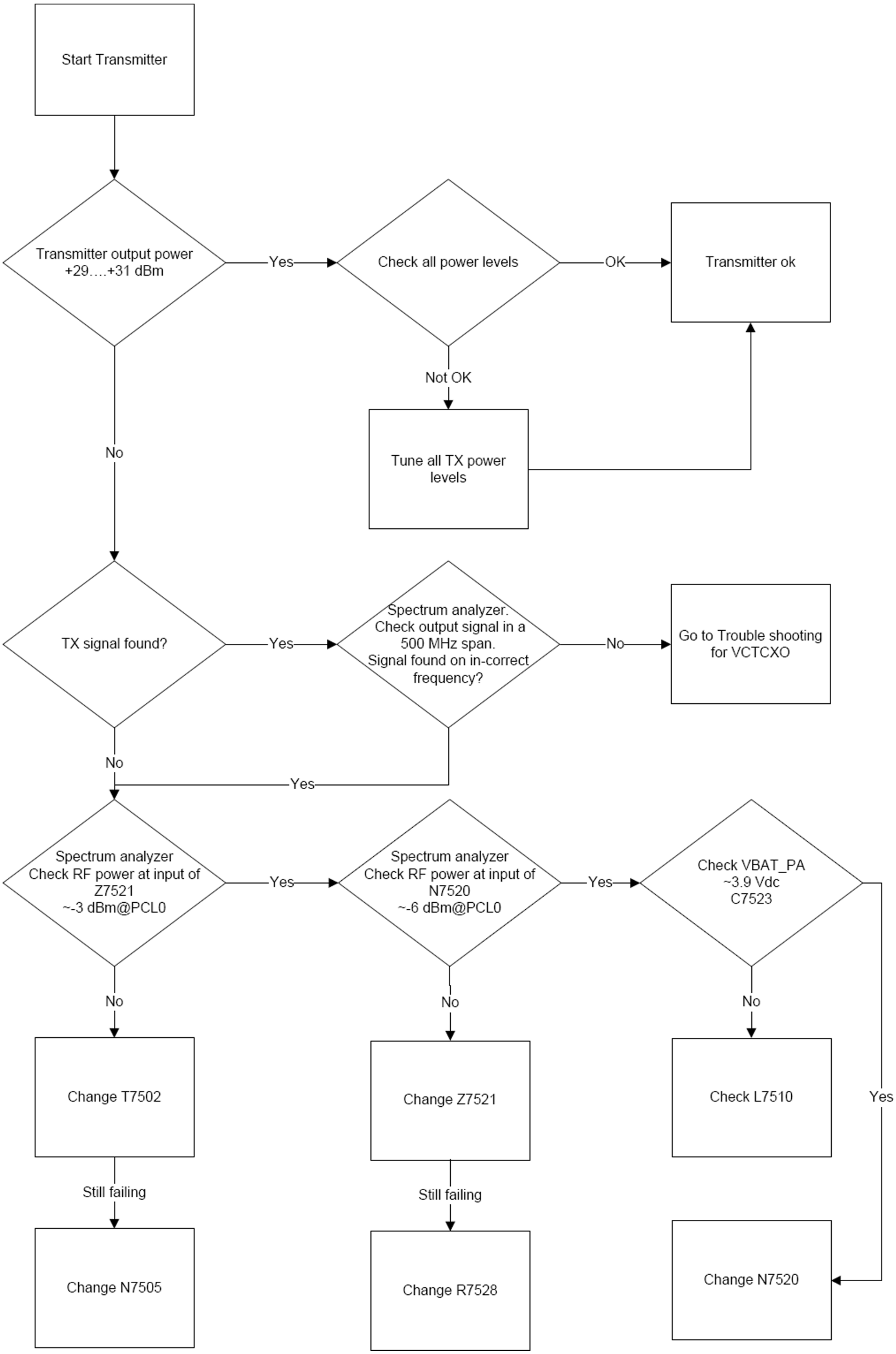
TX 850/900 troubleshooting

Troubleshooting flow


Start Transmitter
Transmitter output power +32....+34 dBm
Yes
Check all power levels
OK
Transmitter ok
Not OK
Tune all TX power levels
No
TX signal found?
Yes
Spectrum analyzer. Check output signal in a 500 MHz span. Signal found on in-correct frequency?
No
Go to VCTCXO troubleshooting
No
Yes
Spectrum analyzer Check RF power on top of Z7503 ~35 dBm@PCL5
Yes
Check VBAT_PA ~3.9 Vdc C7523
Yes
Change N7520
No
No
Change Z7503
Check L7510
Still failing
Change N7505

TX 1800/1900 troubleshooting

Troubleshooting flow


Start Transmitter
Transmitter output power +29….+31 dBm
Yes
Check all power levels
OK
Transmitter ok
Not OK
Tune all TX power levels
No
TX signal found?
Yes
Spectrum analyzer. Check output signal in a 500 MHz span. Signal found on in-correct frequency?
No
Go to Trouble shooting for VCTCXO
No
Yes
Spectrum analyzer Check RF power at input of Z7521 ~-3 dBm@PCL0
Yes
Spectrum analyzer Check RF power at input of N7520 ~-6 dBm@PCL0
Yes
Check VBAT_PA ~3.9 Vdc C7523
No
Change T7502
Still failing
Change N7505
No
Change Z7521
Still failing
Change R7528
No
Check L7510
Yes
Change N7520

Checking antenna functionality

Antenna overview

The RM-243 has a main GSM+WCDMA antenna and a BT antenna.

The main antenna assembly consists of an antenna foil and an antenna frame. There is one feed, two main GND and one extra GND contact on the antenna frame.

The BT antenna assembly consists of a BT frame and a BT flex.

Main antenna functionality

The main GSM+WCDMA antenna is functioning normally when the feed and GND contacts take proper contact to the PWB's C-clips, and the antenna foil is visually intact in the antenna frame.

The main antenna functionality must also be checked by measuring the transmitted power with RF coupler at GSM900 channel 124.

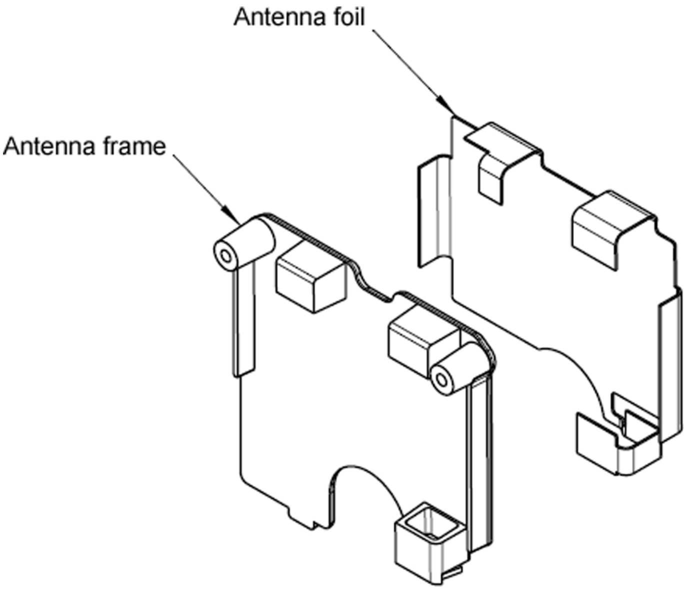


Figure 23 Main antenna components

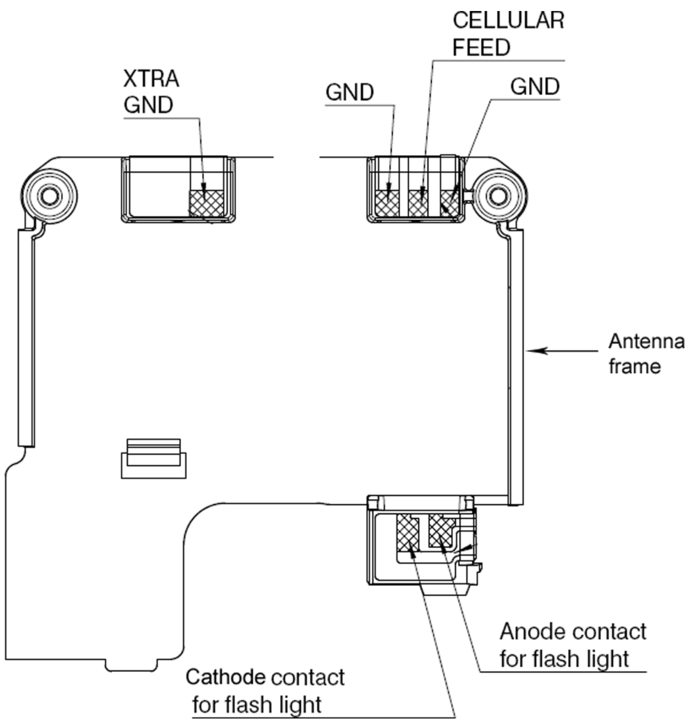

XTRA
GND
GND
CELLULAR
FEED
GND
Antenna
frame
Anode contact
for flash light
Cathode contact
for flash light

Figure 24 Antenna frame contacts

BT antenna functionality

The BT antenna is functioning normally when the BT antenna contacts take proper contact to the PWB's C-clips, and the BT antenna assembly is visually intact in the C-cover.

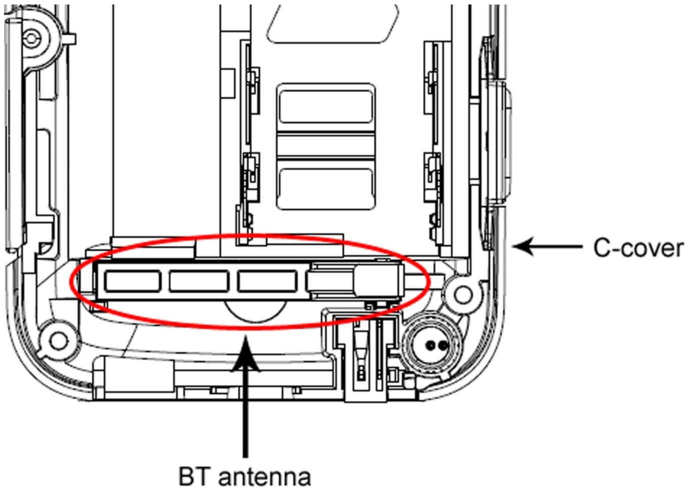

C-cover
BT antenna

Figure 25 BT antenna location

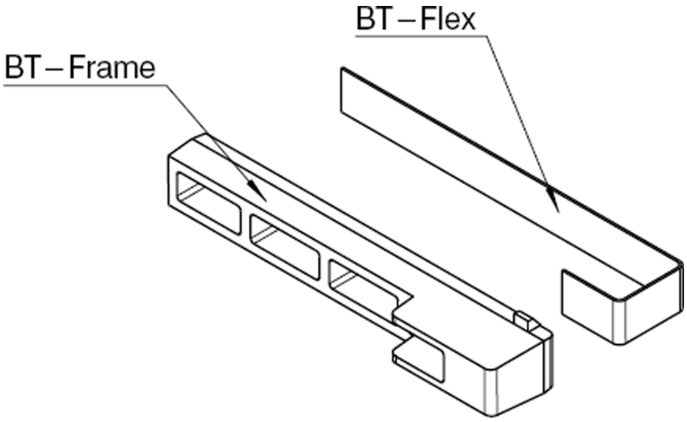
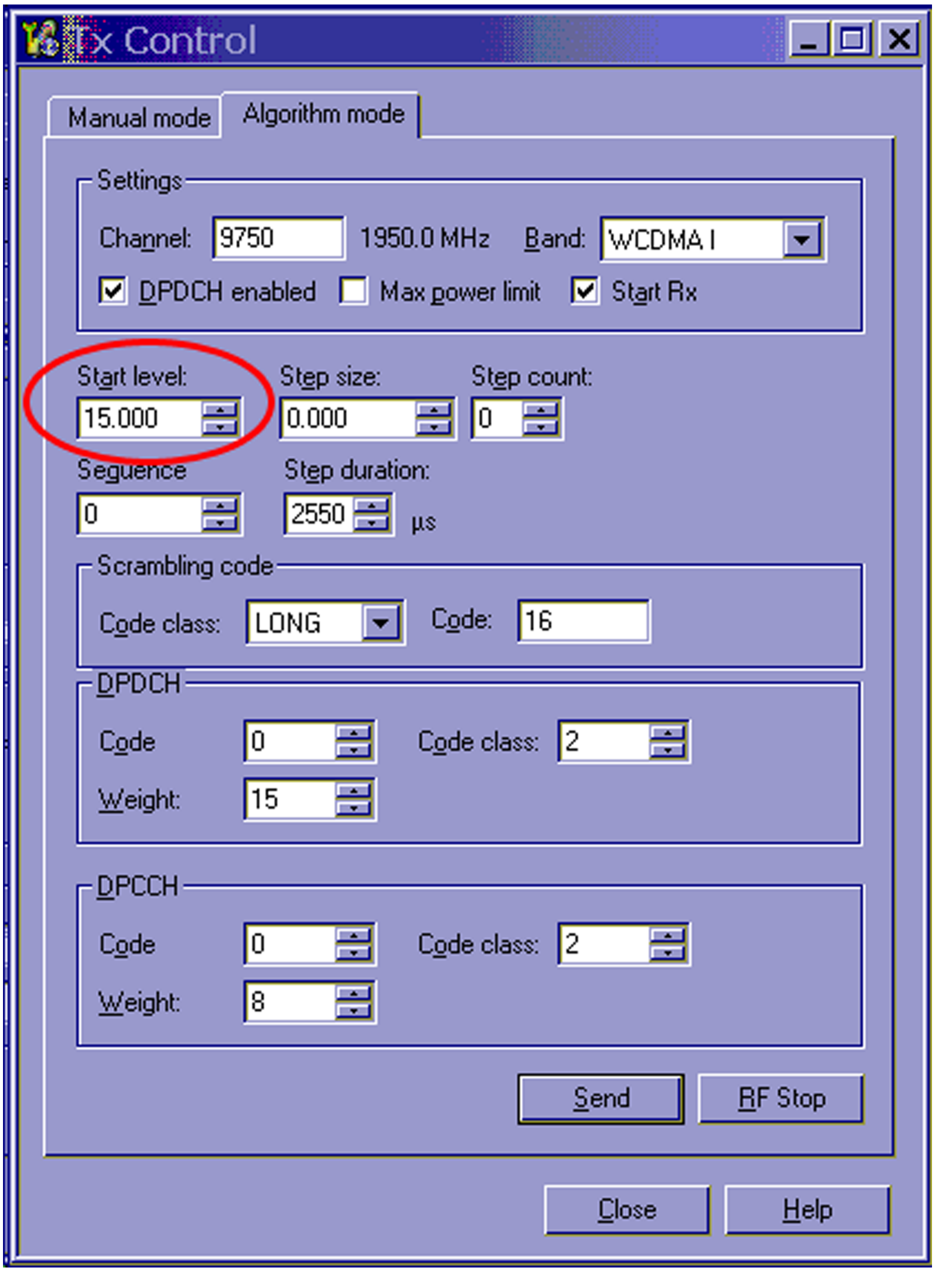


Figure 26 BT antenna assembly components

WCDMA transmitter troubleshooting

Steps

1. Set the phone to local mode.
2. In Phoenix, select **Testing→WCDMA→TX control** .
3. Use the following settings in the TX control window:



Settings

Channel: 9750 1950.0 MHz Band: WCDMA I

☑ DPDCH enabled ☐ Max power limit ☑ Start Rx

Start level: 15.000

Step size: 0.000

Step count: 0

Sequence: 0

Step duration: 2550 µs

Scrambling code

Code class: LONG Code: 16

DPDCH

Code: 0 Code class: 2

Weight: 15

DPCCH

Code: 0 Code class: 2

Weight: 8

Figure 27 Phoenix WCDMA TX control window

Note: Use the **Start level** option to set the TX power level.

4. Click **Send** to enable the settings and activate TX.

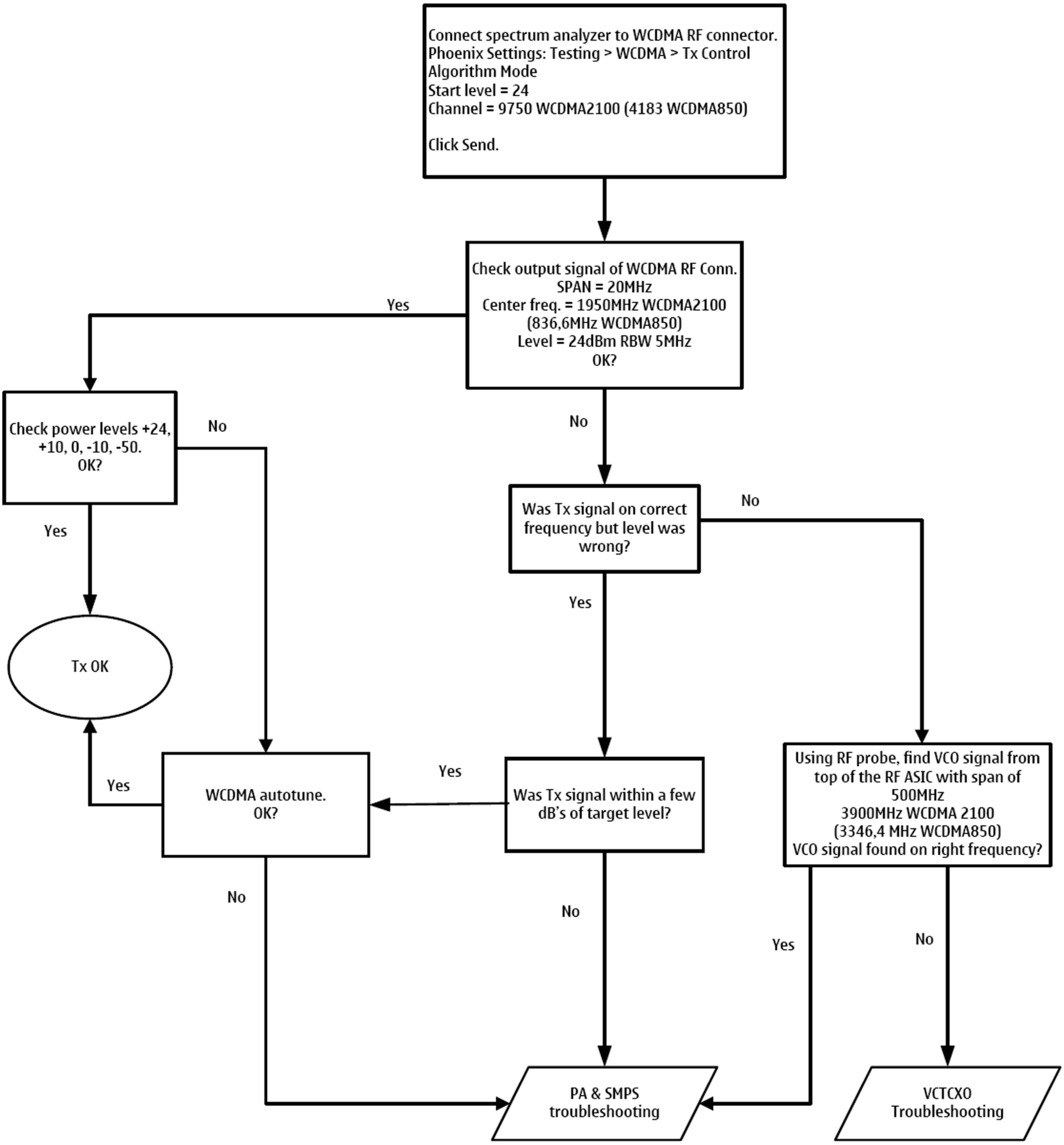
   If settings are changed (eg. new channel), you have to click **RF Stop** and **Send** again.

5. Use the CMU200 to check the WCDMA power.

Figure 28 WCDMA power window

WCDMA transmitter troubleshooting flowchart

Troubleshooting flow


Connect spectrum analyzer to WCDMA RF connector.
Phoenix Settings: Testing > WCDMA > Tx Control
Algorithm Mode
Start level = 24
Channel = 9750 WCDMA2100 (4183 WCDMA850)
Click Send.
Check output signal of WCDMA RF Conn.
SPAN = 20MHz
Center freq. = 1950MHz WCDMA2100
(836,6MHz WCDMA850)
Level = 24dBm RBW 5MHz
OK?
Yes
Check power levels +24, +10, 0, -10, -50. OK?
No
Yes
Tx OK
No
Was Tx signal on correct frequency but level was wrong?
No
Yes
Using RF probe, find VCO signal from top of the RF ASIC with span of 500MHz
3900MHz WCDMA 2100
(3346,4 MHz WCDMA850)
VCO signal found on right frequency?
Yes
WCDMA autotune. OK?
Yes
Was Tx signal within a few dB's of target level?
No
No
Yes
No
PA & SMPS troubleshooting
VCTCXO Troubleshooting

RF tunings

Introduction to RF tunings

Important: Only perform RF tunings if:

- one or more of the RF components have been replaced
- flash memory chip is replaced or corrupted.

RF calibration is always performed with the help of a product-specific module jig, never with an RF coupler. Using an RF coupler in the calibration phase will cause a complete mistuning of the RF part.

Important: After RF component replacements, **always** use autotuning. Manual tunings are only required in rare cases.

Cable and adapter losses

RF cables and adapters have some losses. They have to be taken into account when the phone is tuned. As all RF losses are frequency dependent, the user has to act very carefully and understand the measurement setup.

For RF attenuations of the module jig, please refer to the Service tools section.

Autotuning for BB5

This phone can be tuned automatically.

Autotune is designed to align the phone's RF part easier and faster. It performs calibrations, tunings and measurements of RX and TX. The results are displayed and logged in a result file, if initiated.

Hardware set up

Hardware requirements for auto tuning:

- PC (Windows 2000/XP) with GPIB card
- Power supply
- Product specific module jig
- Cables: XRS-6 (RF cable that requires an additional product-specific adapter cable), USB cable, GBIP cable and DAU-9S
- Signal analyser (TX), signal generator (RX) and RF-splitter *or* one device including all.

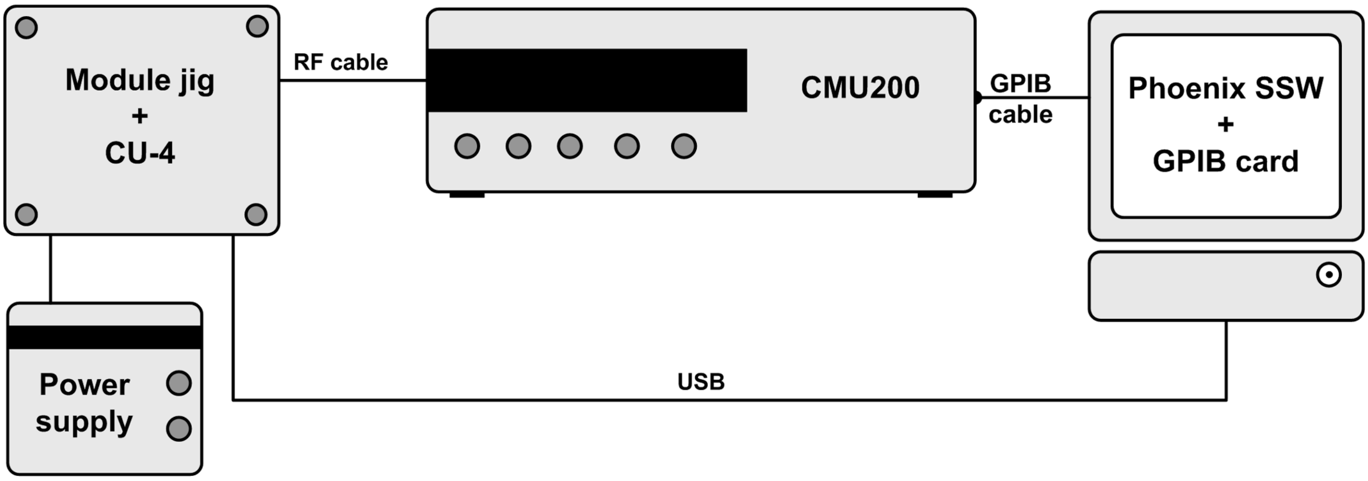


Figure 29 Auto tuning concept with CMU200

Phoenix preparations

Install the phone-specific data package. This defines the phone-specific settings.

Auto tuning procedure

1 Make sure the phone (in the jig) is connected to the equipment. Else, some menus will not be shown in Phoenix.
2 To go to autotune, select *Tuning (Alt-U)* > *Auto-Tune (Alt-A)* from the menu.
3 Remember to set the correct attenuation values before autotuning.
4 To start autotuning, click the *Tune* button.

System mode independent manual tunings

RF channel filter calibration

Context

Rf channel filter calibration tunes the internal low pass filters of the RF ASIC, that limit the bandwidth of BB IQ signals.

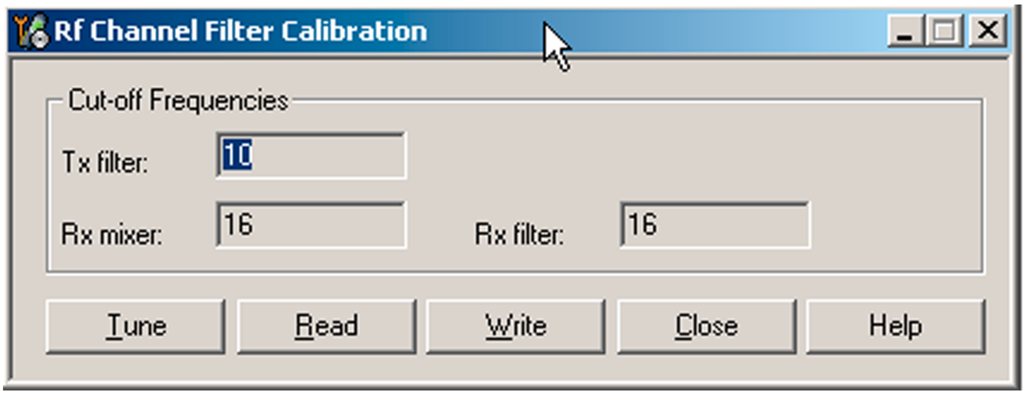
Table 12 Rf channel filter calibration tuning limits

	Min	Typ	Max
Tx filter	0	10	31
RX mixer	0	13	31
Rx filter	0	16	31

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning→Rf Channel Filter Calibration** .
3. Click **Tune**.
4. To save the values to the PMM (Phone Permanent Memory) area, click **Write**.
5. To close the *Rf Channel Filter Calibration* window, click **Close**.

Results



Rf Channel Filter Calibration

Cut-off Frequencies

Tx filter: 10

Rx mixer: 16

Rx filter: 16

Figure 30 Rf channel filter calibration typical values

PA (power amplifier) detection

Context

The PA detection procedure detects which PA manufacturer is used for phone PAs.

If a PA is changed or if the permanent memory (PMM) data is corrupted, PA detection has to be performed before Tx tunings.

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning→PA Detection** .
3. Click **Tune**.
4. Check that the detected PA manufacturers are corresponding to the actual chips on the board.
5. To end the procedure, click **Close**.

GSM receiver tunings

Rx calibration (GSM)

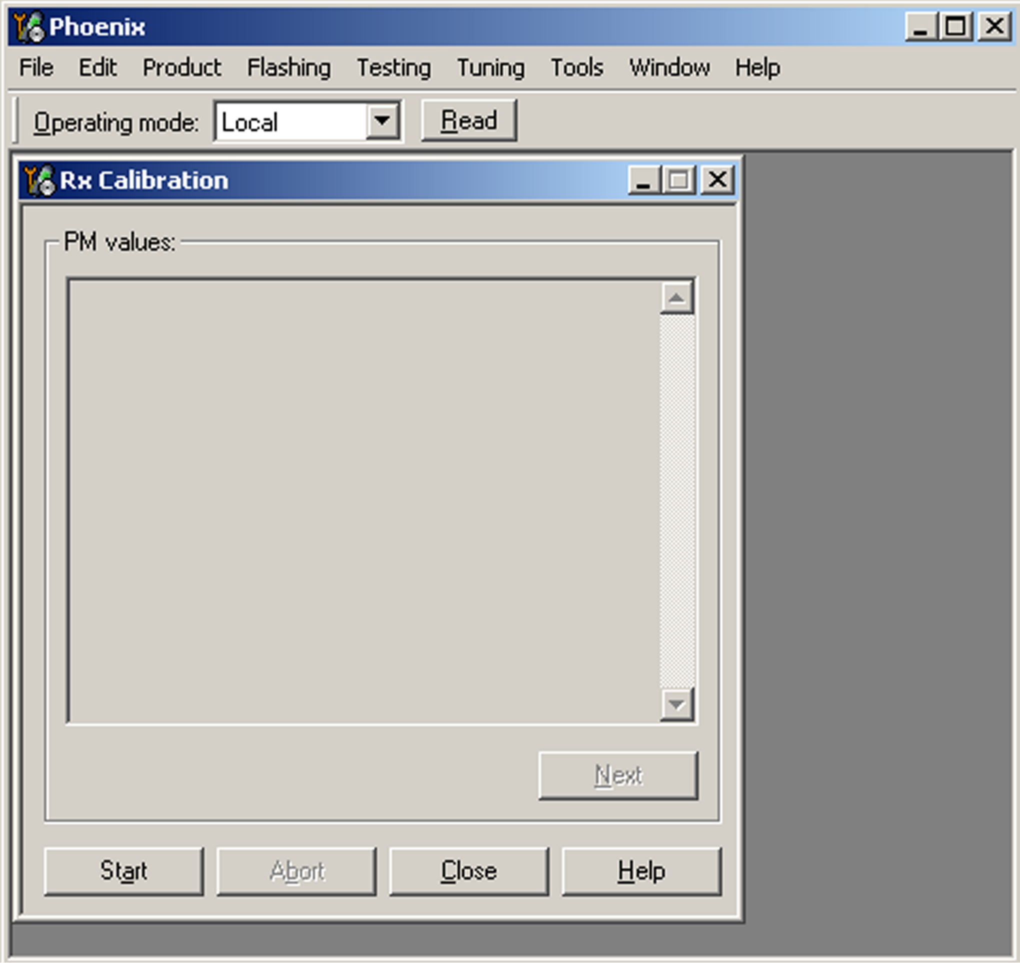
Context

Rx Calibration is used to find out the real gain values of the GSM Rx AGC system and tuning response of the AFC system (AFC D/A init value and AFC slope)

Steps

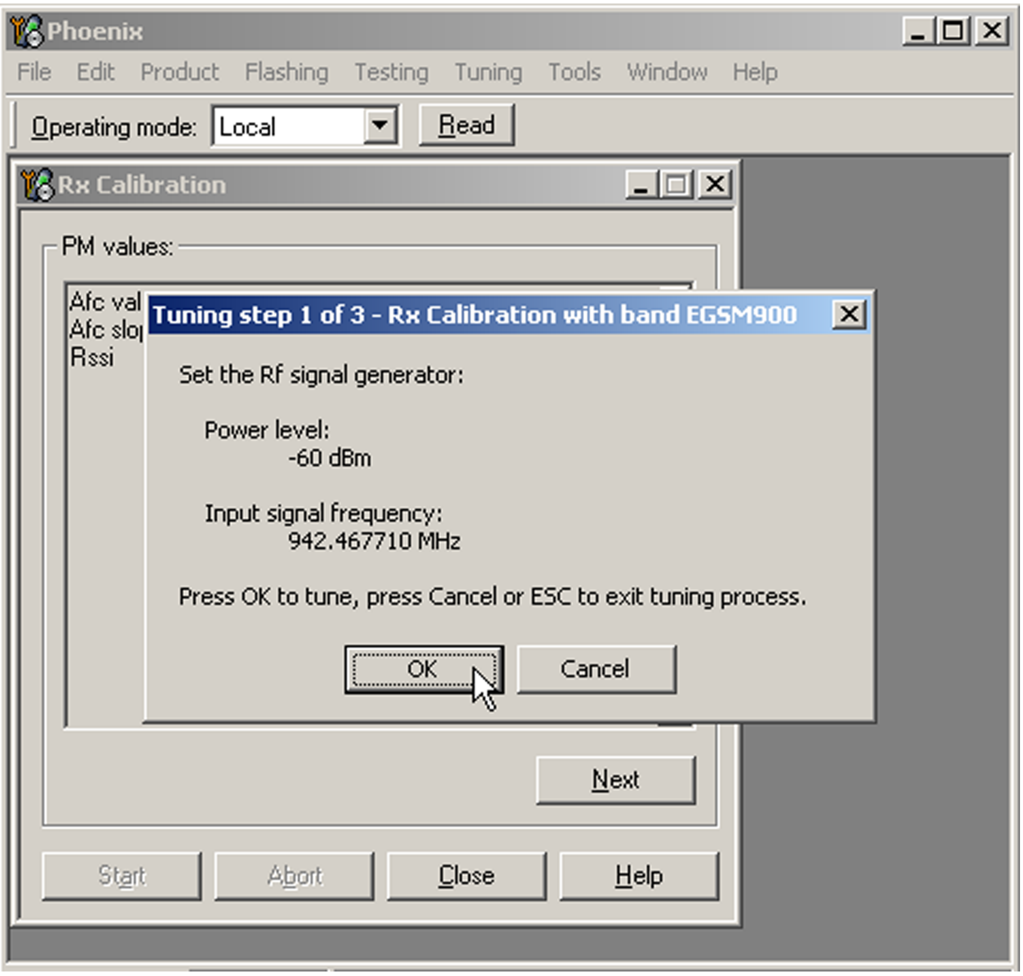
1. Connect the GSM connector of the module jig to a signal generator.
2. Start *Phoenix* service software.
3. From the **Operating mode** drop-down menu, set mode to **Local**.
4. Choose **Tuning→GSM→Rx Calibration** .

5. Click **Start**.


Phoenix
File Edit Product Flashing Testing Tuning Tools Window Help
Operating mode: Local
Read
Rx Calibration
PM values:
Next
Start
Abort
Close
Help

6. Connect the signal generator to the phone, and set frequency and amplitude as instructed in the **Rx Calibration with band EGSM900** (step 1-3) pop-up window.

    Important: The calibration uses a non-modulated CW signal. Increase the signal generator level by cable attenuation and module jig probe attenuation.


Phoenix
File Edit Product Flashing Testing Tuning Tools Window Help
Operating mode: Local
Read
Rx Calibration
PM values:
Afc val
Afc slo
Rssi
Tuning step 1 of 3 - Rx Calibration with band EGSM900
OK
Cancel
Next
Start
Abort
Close
Help

Set the Rf signal generator:

Power level:
-60 dBm

Input signal frequency:
942.467710 MHz

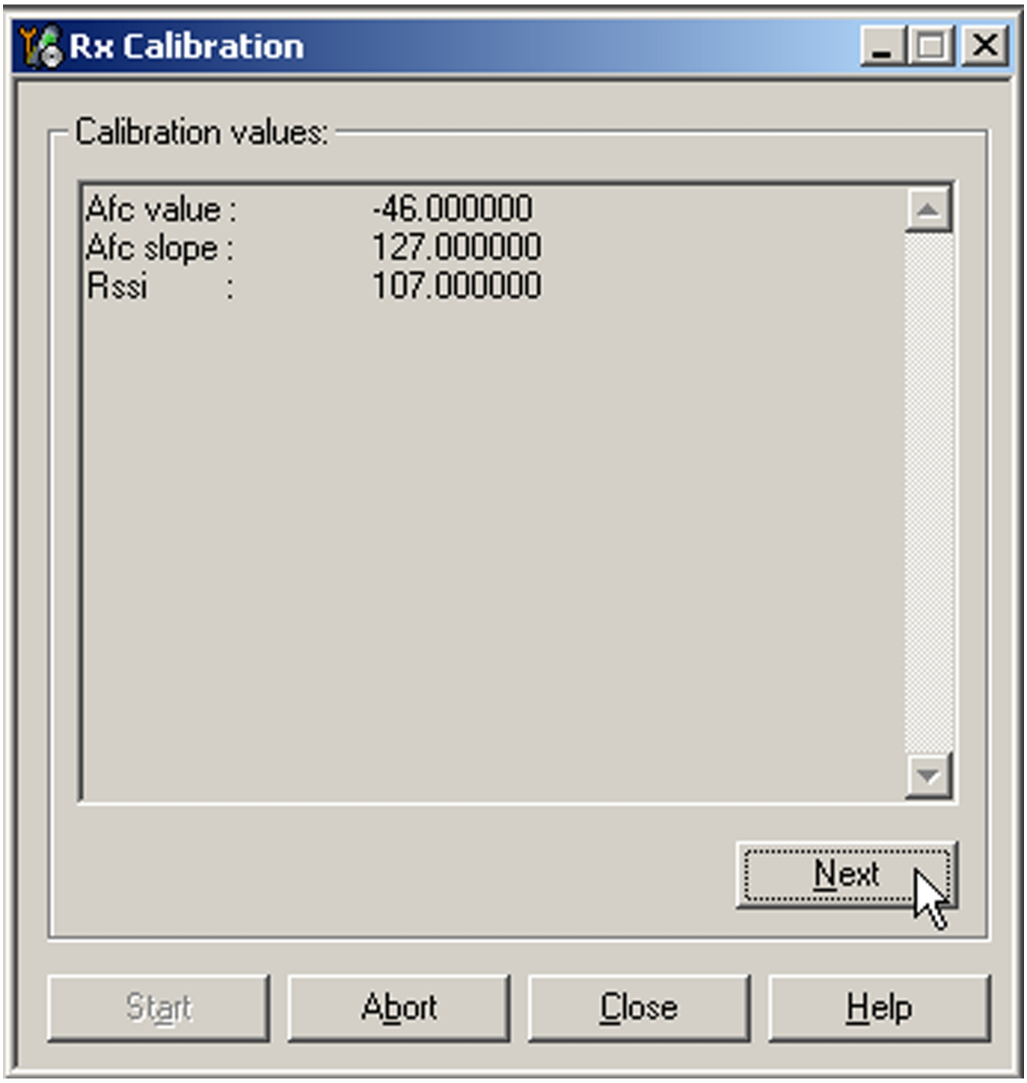
Press OK to tune, press Cancel or ESC to exit tuning process.

7. To perform the tuning, click **OK**.
8. Check that the tuning values are within the limits specified in the following table:

Table 13 RF tuning limits in Rx calibration

	Min	Typ	Max	Unit
GSM850				
AFC Value (init)	-200	-80..40	200	dB
AFC slope	0	108..121	200	dB
RSSI (AGC-0)	106	107..110	114	dB
GSM900				
AFC Value (init)	-200	-105..62	200	dB
AFC slope	0	122	200	dB
RSSI (AGC-0)	106	107...110	114	dB
GSM1800				
RSSI (AGC-0)	105	105...109	114	dB
GSM1900				
RSSI (AGC-0)	105	105...109	114	dB

9. Click **Next** to continue with GSM1800 Rx tuning.



Afc value : -46.000000
Afc slope : 127.000000
Rssi : 107.000000

Next actions

Repeat steps 6 to 9for GSM1800 and GSM1900

Rx band filter response compensation (GSM)

Prerequisites

Rx calibration must be performed before the Rx band filter response compensation.

Context

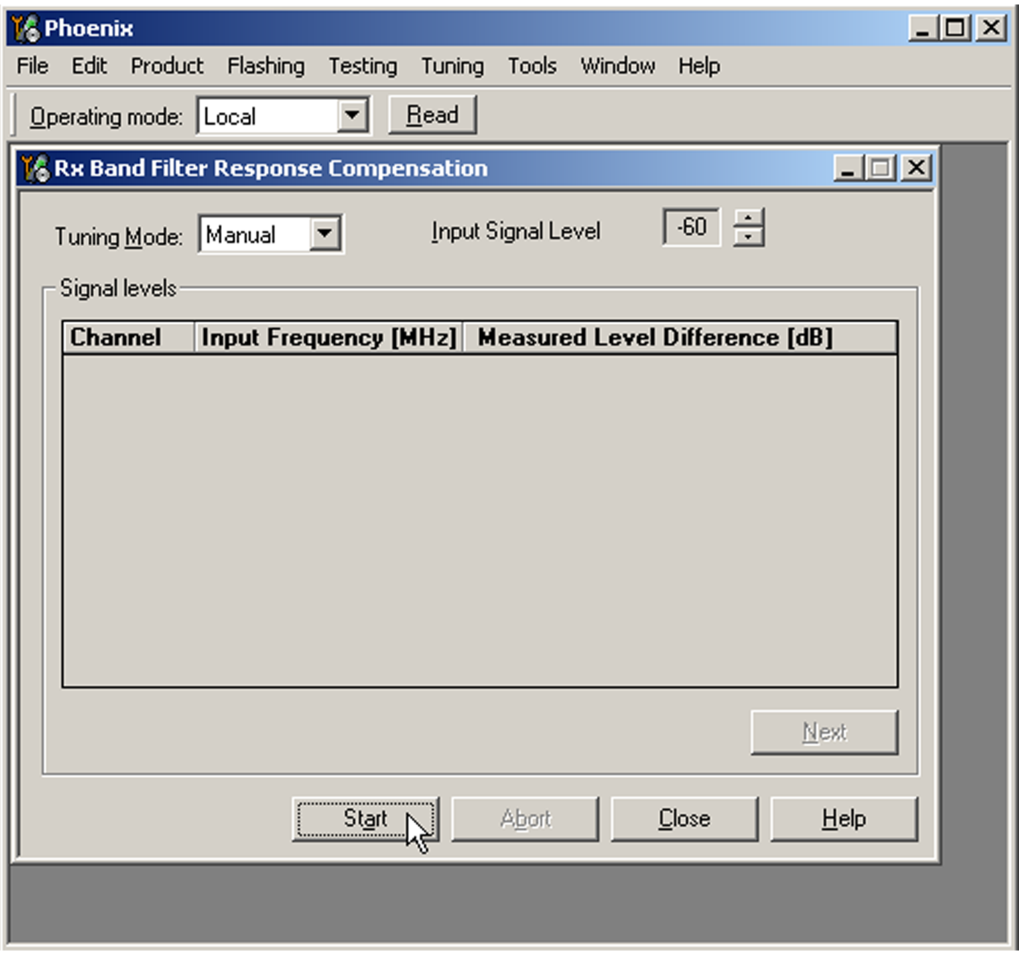
On each GSM Rx band, there is a band filter in front of the RF ASIC front end. The amplitude ripple caused by these filters causes ripple to the RSSI measurement, and therefore calibration is needed.

The calibration has to be repeated for each GSM band.

Steps

1. Connect the GSM connector of the module jig to a signal generator.
2. Start *Phoenix* service software.
3. From the **Operating mode** drop-down menu, set mode to **Local**.

4. Select **GSM900** band.
5. Choose **Tuning→GSM→Rx Band Filter Response Compensation** .
6. Select **Tuning mode: manual**
7. Click **Start**.


Phoenix
File Edit Product Flashing Testing Tuning Tools Window Help
Read
Rx Band Filter Response Compensation
Signal levels
Next
Start
Abort
Close
Help

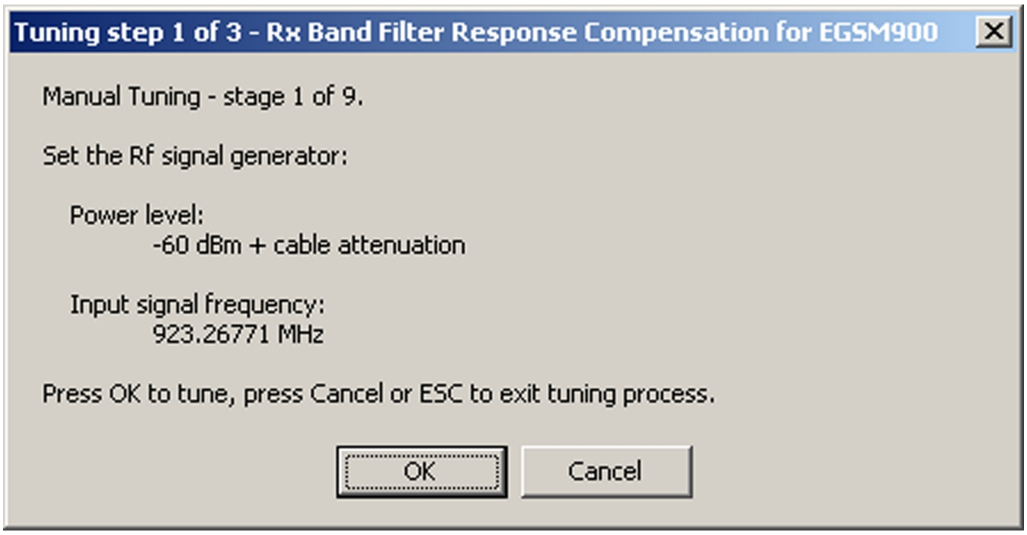
Operating mode: Local

Tuning Mode: Manual

Input Signal Level -60

Channel	Input Frequency [MHz]	Measured Level Difference [dB]

8. Connect the signal generator to the phone, and set frequency and amplitude as instructed in the *Rx Band Filter Response Compensation for EGSM900* pop-up window, step 1-3.



Tuning step 1 of 3 - Rx Band Filter Response Compensation for EGSM900

Manual Tuning - stage 1 of 9.

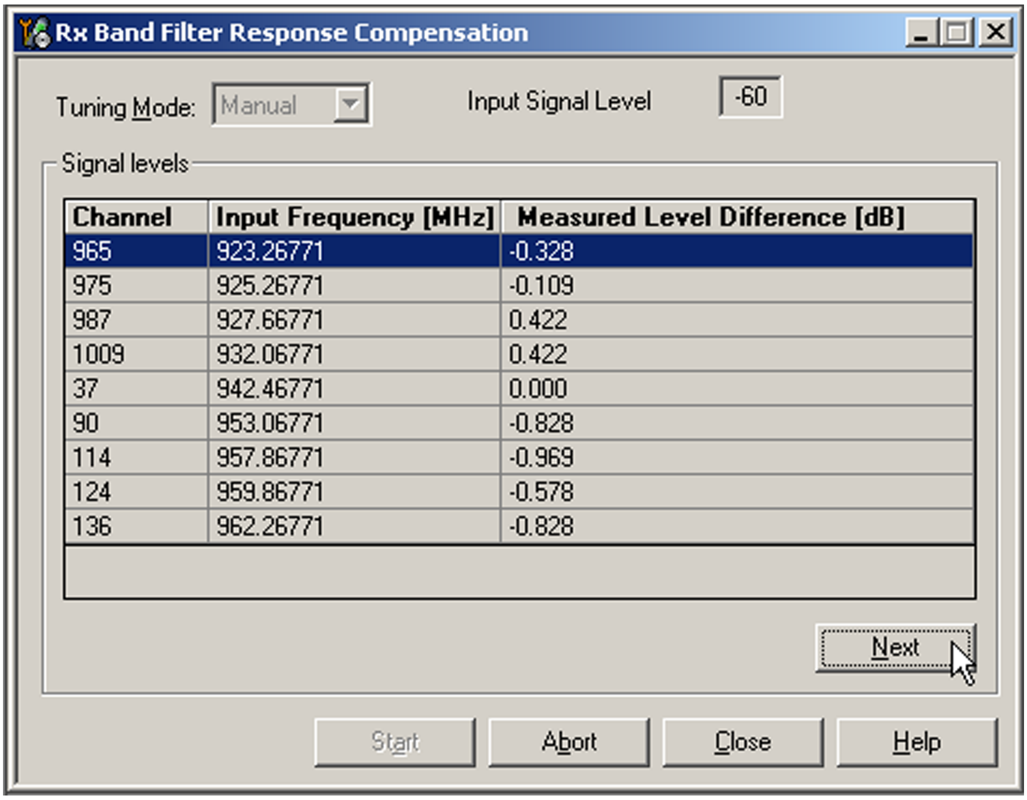
Set the Rf signal generator:

Power level:
-60 dBm + cable attenuation

Input signal frequency:
923.26771 MHz

Press OK to tune, press Cancel or ESC to exit tuning process.

9. To perform tuning, click **OK**.
10. Go through all 9 frequencies. The following table will be shown:



Tuning Mode: Manual

Input Signal Level -60

Signal levels

Channel	Input Frequency [MHz]	Measured Level Difference [dB]
965	923.26771	-0.328
975	925.26771	-0.109
987	927.66771	0.422
1009	932.06771	0.422
37	942.46771	0.000
90	953.06771	-0.828
114	957.86771	-0.969
124	959.86771	-0.578
136	962.26771	-0.828

11. Check that the tuning values are within the limits specified in the following table:

	Min	Typ	Max	Unit
GSM850				
Ch. 118/867.26771 MHz	-6	-1	2	dB
Ch. 128/869.26771 MHz	-3	0	2	dB
Ch. 140/871.66771 MHz	-3	0	2	dB
Ch. 172/878.06771 MHz	-2	0	2	dB
Ch. 190/881.66771 MHz	-2	0	2	dB
Ch. 217 / 887.06771 MHz	-2	0	2	dB
Ch. 241/891.86771 MHz	-3	0	2	dB
Ch. 251/893.86771 MHz	-3	0	2	dB
Ch. 261/895.86771 MHz	-6	-1	-2	dB
GSM900				
Ch. 965 / 923.26771 MHz	-6	-1	2	dB
Ch. 975 / 925.26771 MHz	-3	0	2	dB
Ch. 987 / 927.66771 MHz	-3	0	2	dB
Ch. 1009 / 932.06771 MHz	-2	0	2	dB

	Min	Typ	Max	Unit
Ch. 37 / 942.46771 MHz	-2	0	2	dB
Ch. 90 / 953.06771 MHz	-2	0	2	dB
Ch. 114 / 957.86771 MHz	-3	0	2	dB
Ch. 124 / 959.86771 MHz	-3	0	2	dB
Ch. 136 / 962.26771 MHz	-6	-1	2	dB
GSM1800				
Ch. 497 / 1802.26771 MHz	-6	-1	3	dB
Ch. 512 / 1805.26771 MHz	-3	0	3	dB
Ch. 535 / 1809.86771 MHz	-3	0	3	dB
Ch. 606 / 1824.06771 MHz	-3	0	3	dB
Ch. 700 / 1842.86771 MHz	-3	0	3	dB
Ch. 791 / 1861.06771 MHz	-3	0	3	dB
Ch. 870 / 1876.86771 MHz	-3	0	3	dB
Ch. 885 / 1879.86771 MHz	-3	0	3	dB
Ch. 908 / 1884.46771 MHz	-6	-1	3	dB
GSM1900				
Ch. 496 / 1927.06771 MHz	-6	-1	2	dB
Ch. 512 / 1930.26771 MHz	-3	0	2	dB
Ch. 537 / 1935.26771 MHz	-3	0	2	dB
Ch. 586 / 1945.06771 MHz	-3	0	2	dB
Ch. 661 / 1960.06771 MHz	-3	0	2	dB
Ch. 736 / 1975.06771 MHz	-3	0	2	dB
Ch. 794 / 1986.66771 MHz	-3	0	2	dB
Ch. 810 / 1989.86771 MHz	-3	0	2	dB
Ch. 835 / 1994.86771 MHz	-6	-1	2	dB

12. If the values are within the limits, click **Next** to continue to the next band.

Next actions

Repeat the steps 8 to 12 for GSM1800 and GSM1900.

GSM transmitter tunings

Tx IQ tuning (GSM)

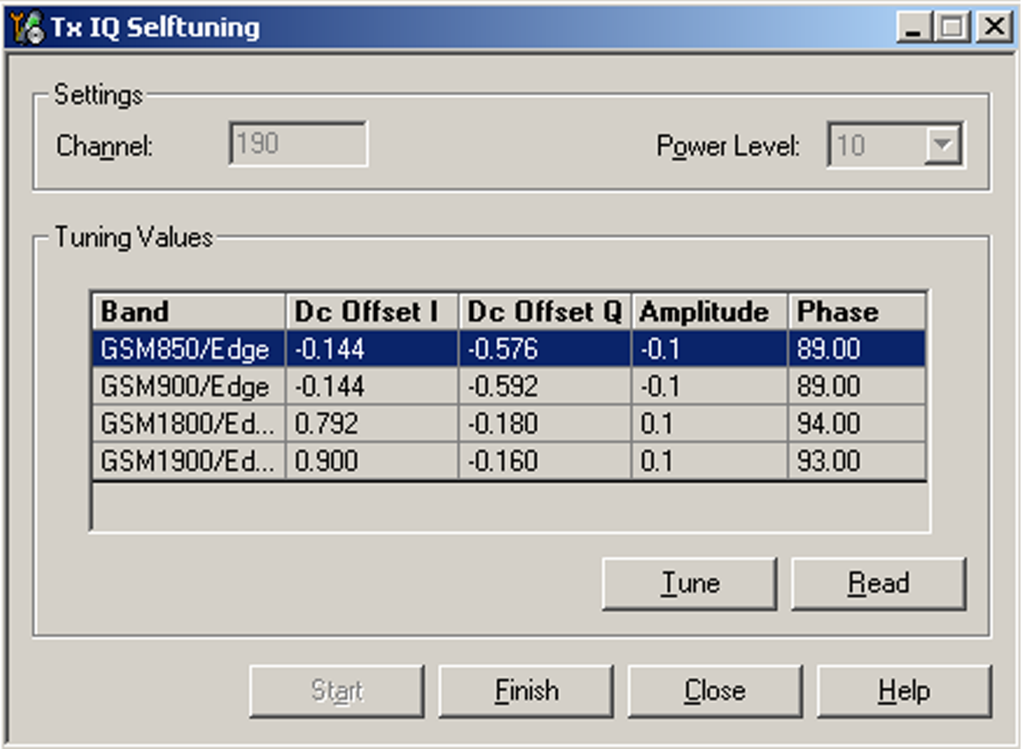
Context

The Tx path branches to I and Q signals at RF I/Q modulator. Modulator and analog hardware located after it cause unequal amplitude and phase disturbance to I and Q signal paths. Tx IQ tuning balances the I and Q branches.

Tx IQ tuning must be performed for all GSM bands.

Steps

1. Start *Phoenix* service software.
2. From the **Operating mode** drop-down menu, set mode to **Local**.
3. Choose **Tuning→GSM→Tx IQ Tuning** .
4. Select **Mode: Automatic**.


Tx IQ Selftuning
Settings
Channel:
190
Power Level:
10
Tuning Values
Tune
Read
Start
Finish
Close
Help

Band	Dc Offset I	Dc Offset Q	Amplitude	Phase
GSM850/Edge	-0.144	-0.576	-0.1	89.00
GSM900/Edge	-0.144	-0.592	-0.1	89.00
GSM1800/Ed...	0.792	-0.180	0.1	94.00
GSM1900/Ed...	0.900	-0.160	0.1	93.00

5. Select **Band: GSM900** and click **Start**.
6. Click **Next** to start GSM1800 band TX IQ tuning.
7. Click **Next** to start GSM1900 band TX IQ tuning.
8. Click**Finish** and then **Close**.

Next actions

Tuning sliders should be close to the center of the scale after the tuning and within the limits specified in the following table. If they are not within the limits, check Tx IQ quality manually.

	Min	Typ	Max	Unit
GSM850				
I DC offset / Q DC offset	-6	-4	6	%
Ampl	-1	0	1	dB
Phase	85	90	95	°
GSM900				

	Min	Typ	Max	Unit
I DC offset / Q DC offset	-6	-4	6	%
Ampl	-1	0	1	dB
Phase	85	90	95	°
GSM1800/GSM1900				
I/Q DC	-6	0.5	6	%
Ampl	-1	0	1	dB
Phase	95	100	110	°

Tx power level tuning (GSM)

Context

Because of variations at the IC (Integrated Circuit) process and discrete component values, the actual transmitter RF gain of each phone is different. Tx power level tuning is used to find out mapping factors called 'power coefficients’. These adjust the GSM transmitter output power to fulfill the specifications.

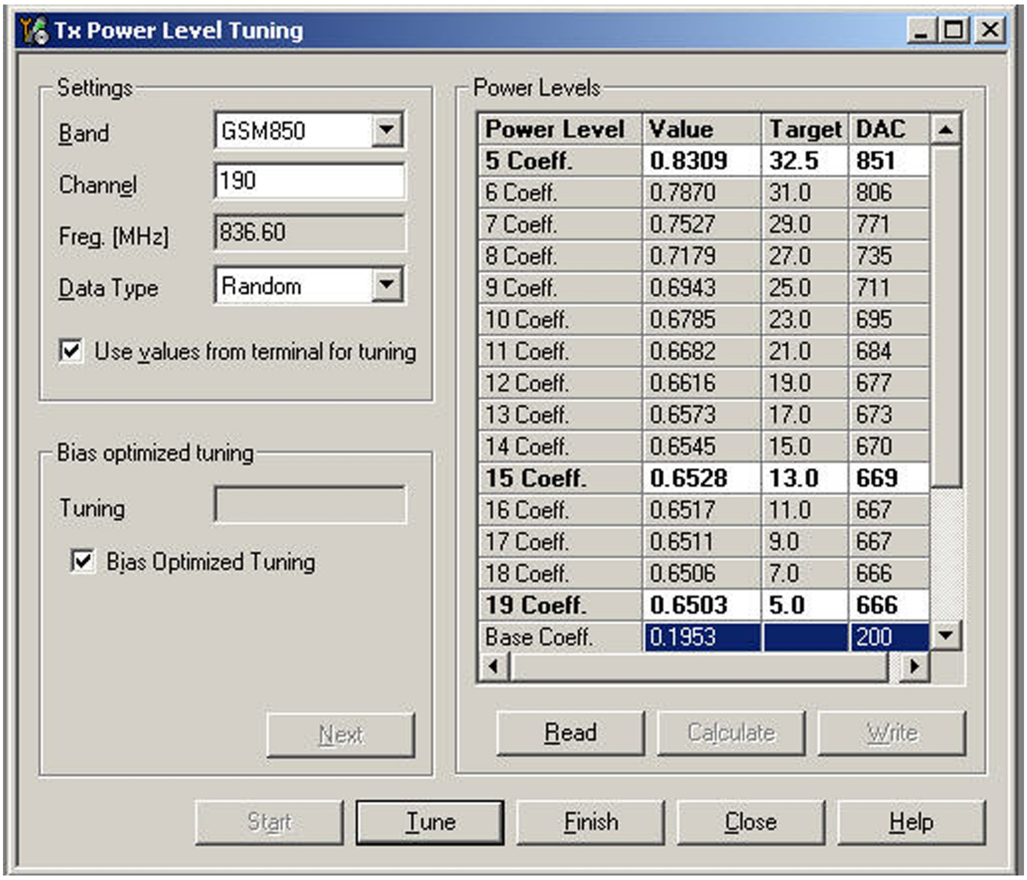
For EDGE transmission, the bias settings of the GSM PA are adjusted in order to improve linearity. This affects the PA gain and hence the power levels have to be aligned separately for EDGE transmission.

Tx power level tuning has to be performed on all GSM bands.

Steps

1. Connect the phone to a spectrum analyzer.
2. Start *Phoenix* service software.
3. From the **Operating mode** drop-down menu, set mode to **Local**.
4. Choose **Tuning→GSM→Tx Power Level Tuning** .

5. Click **Start**.l


Tx Power Level Tuning
Settings
Bias optimized tuning
Power Levels
Next
Read
Calculate
Write
Start
Tune
Finish
Close
Help

Band: GSM850

Channel: 190

Freq. [MHz]: 836.60

Data Type: Random

☑ Use values from terminal for tuning

Tuning:

☑ Bias Optimized Tuning

Power Level	Value	Target	DAC
5 Coeff.	**0.8309**	**32.5**	**851**
6 Coeff.	0.7870	31.0	806
7 Coeff.	0.7527	29.0	771
8 Coeff.	0.7179	27.0	735
9 Coeff.	0.6943	25.0	711
10 Coeff.	0.6785	23.0	695
11 Coeff.	0.6682	21.0	684
12 Coeff.	0.6616	19.0	677
13 Coeff.	0.6573	17.0	673
14 Coeff.	0.6545	15.0	670
15 Coeff.	**0.6528**	**13.0**	**669**
16 Coeff.	0.6517	11.0	667
17 Coeff.	0.6511	9.0	667
18 Coeff.	0.6506	7.0	666
19 Coeff.	**0.6503**	**5.0**	**666**
Base Coeff.	0.1953		200

6. Set the spectrum analyzer for power level tuning:

Frequency	Channel frequency: • **836.6 MHz GSM850** • **897.4MHz GSM900** • **1747.8MHz GSM1800** • **1880MHz GSM1900**
Span	0 Hz
Sweep time	2ms
Trigger	Video triggering (-10dBm)
Resolution BW	3MHz
Video BW	3MHz
Reference level offset	sum cable attenuation with module jig attenuation
Reference level	33dBm

A power meter with a peak power detector can be also used. Remember to take the attenuations into account.

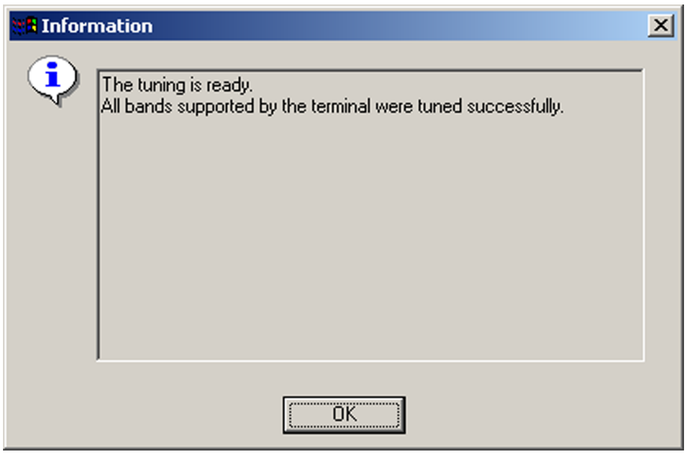
7. Set the tuning targets according to the values in the table below

GMSK	1Slot	2 slot	3 slot
850	32,5	32,5	31,2
900	32,5	32,5	31,2
1800	30	30	28,2
1900	30	30	28,2
EDGE	1Slot	2 slot	3 slot
850	26,5	26,5	24,7
900	26,5	26,5	24,7
1800	25	25	23,2
1900	25	25	23,2
WCDMA Band I	23.5 dBm		
WCDMA Band V	24 dBm		

8. Adjust power for all bold power levels to correspond the **Target dBm** column by pressing **+** or **–** keys.
9. If all bold power levels are adjusted, click **Next** to continue with **GSM850 EDGE**.
10. Adjust power for all bold power levels to correspond the **Target dBm** column by pressing **+** or **–** keys.

Next actions

Continue tuning the bold power levels of the GSM900, GSM1800 and GSM1900 bands. You will see this message, if finished successfully:



The tuning is ready.
All bands supported by the terminal were tuned successfully.

WCDMA receiver tunings

RX calibration (WCDMA)

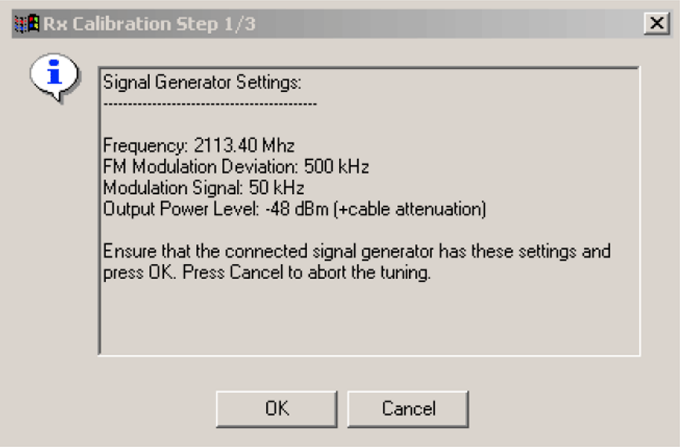
Context

Rx calibration tuning routine calculates the real gain values of the WCDMA Rx AGC system. There is also a SAW filter between front end LNA and mixer in the receive chain, which causes ripple in the RSSI measurement, this is calibrated out. The SAW filter is intergated into RF ASIC N7500.

Rx calibration can be done in two different ways, manual tune and sweep mode tune. If the signal generator in use supports frequency sweep table, the calibration is done in one step.

Steps

1. For manual tuning, set mode to **Local** in the **Operating Mode** dropdown menu.
2. In the **Tuning** menu, choose **WCDMA→Rx Calibration** .
3. Click **Start**.
4. Select Band "WCDMA2100 or WCDMA850".
5. Click **Tune**.
6. Setup the signal generator to correspond with the values on the, *Rx Calibration* pop-up window and click **OK**.



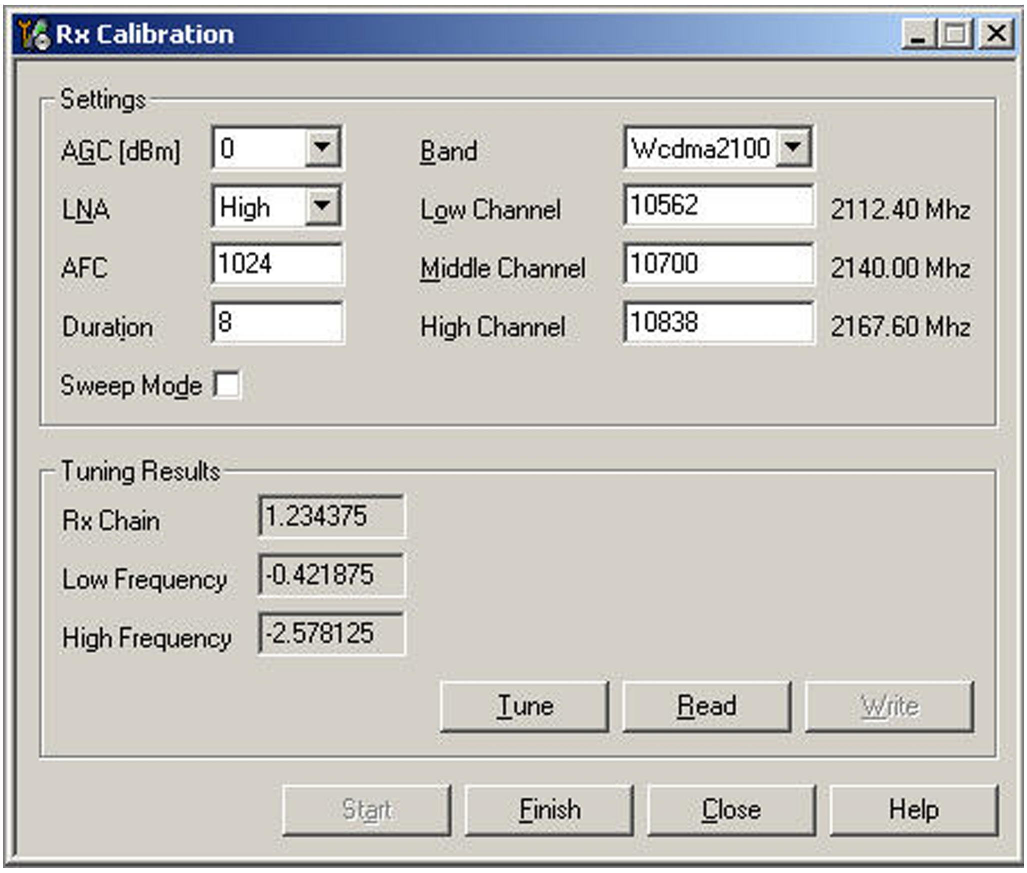
Signal Generator Settings:

Frequency: 2113.40 Mhz
FM Modulation Deviation: 500 kHz
Modulation Signal: 50 kHz
Output Power Level: -48 dBm (+cable attenuation)

Ensure that the connected signal generator has these settings and press OK. Press Cancel to abort the tuning.

Figure 31 Pop-up window for WCDMA2100

7. Repeat step 6. for Middle and High channels.



AGC [dBm] 0

LNA High

AFC 1024

Duration 8

Sweep Mode ☐

Band Wcdma2100

Low Channel 10562 2112.40 Mhz

Middle Channel 10700 2140.00 Mhz

High Channel 10838 2167.60 Mhz

Rx Chain 1.234375

Low Frequency -0.421875

High Frequency -2.578125

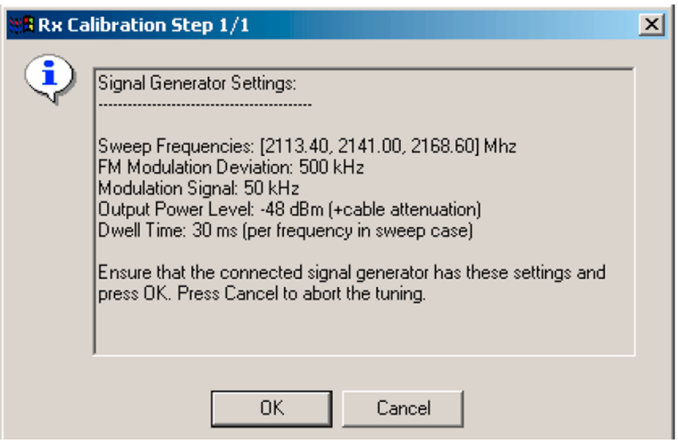
8. Ensure Tuning Results are within limits specified in the table below:
   If values are OK, click **Write** to save the values.

	Band	Min	Typ	Max	Unit
Rx chain	2100 or 850	-6	1.5 to 3.5	6	dB
Low Frequency		-5	-0.7 to 4.0	5	
High Frequency		-5	-0.7 to 4.0	5	

Alternative steps

- For sweep mode tuning, set **Mode** to **Local** in the **Operating Mode** dropdown menu.
- In the **Tuning** menu, choose **WCDMA**→ **Rx Calibration** .
- Click **Start**.
- Select **Band**, "WCDMA2100 or WCDMA850".
- Check the **Sweep Mode** box.
- Click **Tune**.

- Setup the signal generator to correspond with the values on the *Rx Calibration* pop-up window and click **OK**.



Signal Generator Settings:

Sweep Frequencies: [2113.40, 2141.00, 2168.60] Mhz
FM Modulation Deviation: 500 kHz
Modulation Signal: 50 kHz
Output Power Level: -48 dBm (+cable attenuation)
Dwell Time: 30 ms (per frequency in sweep case)

Ensure that the connected signal generator has these settings and press OK. Press Cancel to abort the tuning.

Figure 32 Pop-up window for WCDMA2100

- Ensure Tuning Results are within limits specified in the table above: If values are OK, click **Write** to save the values to the phone.
- Close the tuning window.

WCDMA transmitter tunings

Tx AGC & power detector (WCDMA)

Context

Tx AGC & power detector tuning has two purposes:

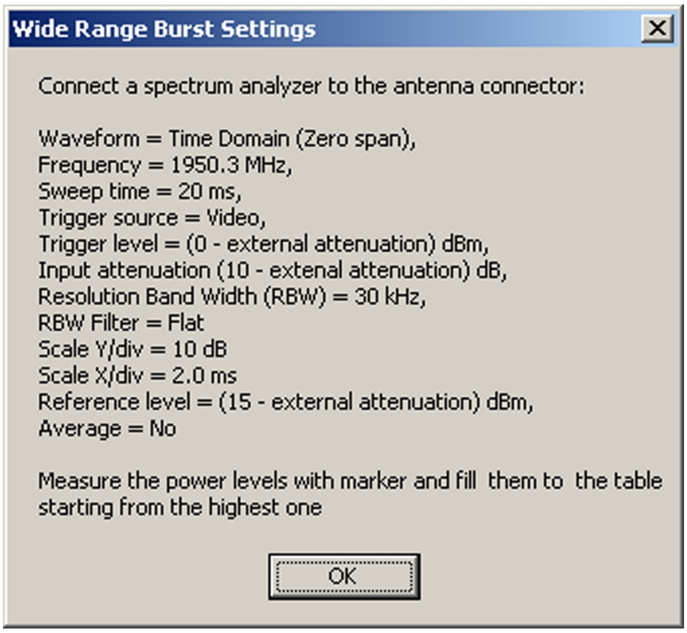
- to enable the phone to select the correct TxC value accurately in order to produce the required RF level
- to enable the phone to measure its own transmitter power accurately

There are two ways to perform the tuning. For an alternative method, see Alternative steps (page 4–51).

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning→WCDMA→Tx AGC & Power Detector.**
3. Click **Start**.
4. In the *Wide Range* pane, click **Tune** (the leftmost **Tune** button).

5. Set up the spectrum analyzer in the following way:



Connect a spectrum analyzer to the antenna connector:

Waveform = Time Domain (Zero span),
Frequency = 1950.3 MHz,
Sweep time = 20 ms,
Trigger source = Video,
Trigger level = (0 - external attenuation) dBm,
Input attenuation (10 - extenal attenuation) dB,
Resolution Band Width (RBW) = 30 kHz,
RBW Filter = Flat
Scale Y/div = 10 dB
Scale X/div = 2.0 ms
Reference level = (15 - external attenuation) dBm,
Average = No

Measure the power levels with marker and fill them to the table starting from the highest one

6. After setting the spectrum analyzer, click **OK**.
7. Measure the power levels with a marker.

   Take the first measurement from 250 us after the trigger, the second after 750 us, the third after 1250 us and so on for every 500 us until the table is filled.

   > **Note:** It must be possible to measure power levels down to –68 dBm. The measured power levels must be monotonously decreasing.
   >
   > Make sure that the marker is not measuring the level of noise spikes on lower levels.

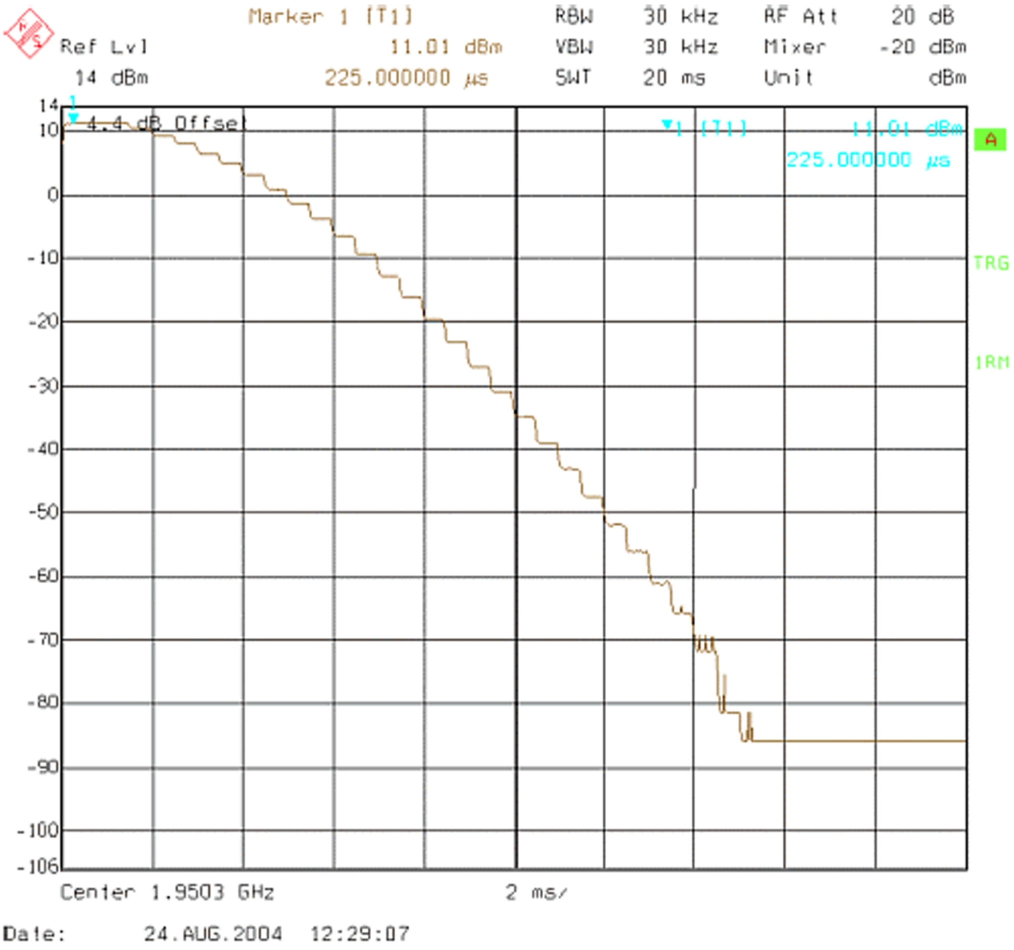
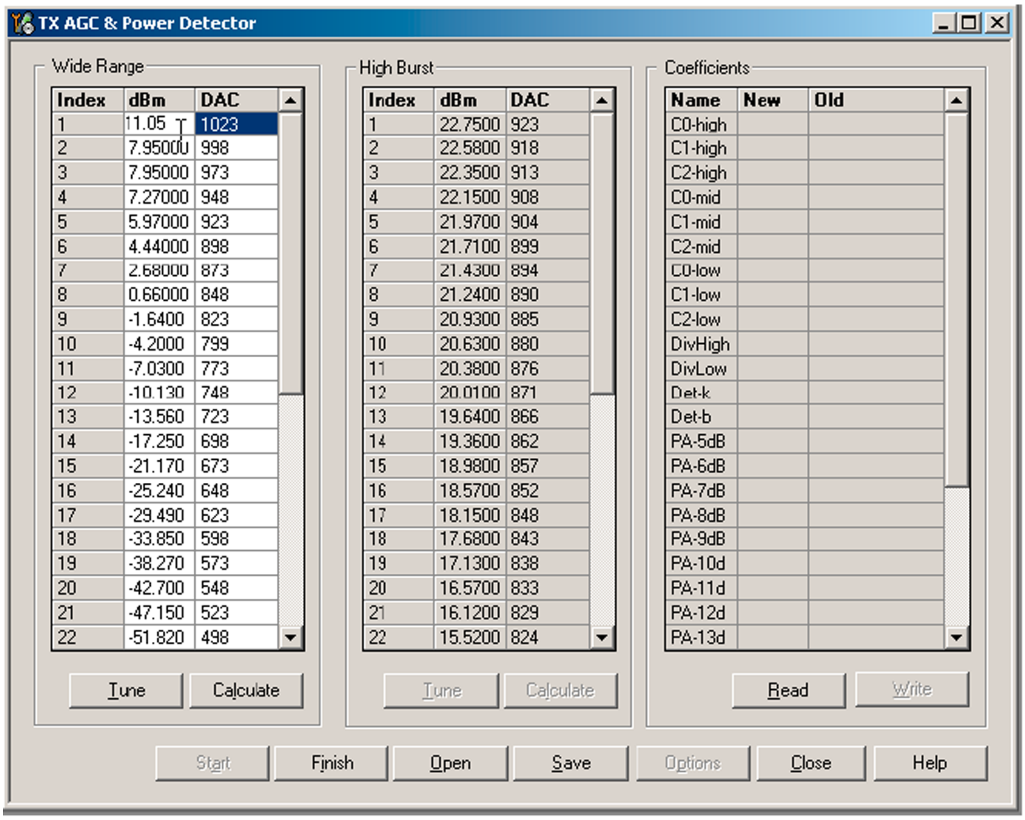


Figure 33 WCDMA power level tuning steps

8. Fill in the power level values (in dBm) to the *Wide Range* table.


TX AGC & Power Detector
Wide Range
High Burst
Coefficients
Tune
Calculate
Tune
Calculate
Read
Write
Start
Finish
Open
Save
Options
Close
Help

Wide Range

Index	dBm	DAC
1	11.05	1023
2	7.95000	998
3	7.95000	973
4	7.27000	948
5	5.97000	923
6	4.44000	898
7	2.68000	873
8	0.66000	848
9	-1.6400	823
10	-4.2000	799
11	-7.0300	773
12	-10.130	748
13	-13.560	723
14	-17.250	698
15	-21.170	673
16	-25.240	648
17	-29.490	623
18	-33.850	598
19	-38.270	573
20	-42.700	548
21	-47.150	523
22	-51.820	498

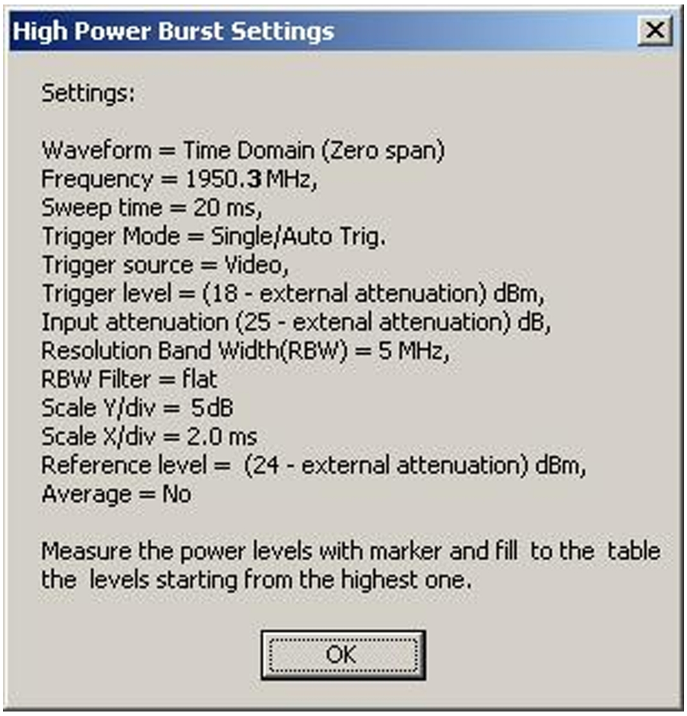
High Burst

Index	dBm	DAC
1	22.7500	923
2	22.5800	918
3	22.3500	913
4	22.1500	908
5	21.9700	904
6	21.7100	899
7	21.4300	894
8	21.2400	890
9	20.9300	885
10	20.6300	880
11	20.3800	876
12	20.0100	871
13	19.6400	866
14	19.3600	862
15	18.9800	857
16	18.5700	852
17	18.1500	848
18	17.6800	843
19	17.1300	838
20	16.5700	833
21	16.1200	829
22	15.5200	824

Coefficients

Name	New	Old
C0-high		
C1-high		
C2-high		
C0-mid		
C1-mid		
C2-mid		
C0-low		
C1-low		
C2-low		
DivHigh		
DivLow		
Det-k		
Det-b		
PA-5dB		
PA-6dB		
PA-7dB		
PA-8dB		
PA-9dB		
PA-10d		
PA-11d		
PA-12d		
PA-13d		

9. In the *Wide Range* pane, click **Calculate**.
10. In the *High Burst* pane, click **Tune**.
11. Adjust the spectrum analyzer according to the following settings:


High Power Burst Settings
OK

Settings:

Waveform = Time Domain (Zero span)
Frequency = 1950.3 MHz,
Sweep time = 20 ms,
Trigger Mode = Single/Auto Trig.
Trigger source = Video,
Trigger level = (18 - external attenuation) dBm,
Input attenuation (25 - extenal attenuation) dB,
Resolution Band Width(RBW) = 5 MHz,
RBW Filter = flat
Scale Y/div = 5dB
Scale X/div = 2.0 ms
Reference level = (24 - external attenuation) dBm,
Average = No

Measure the power levels with marker and fill to the table the levels starting from the highest one.

12. Measure the power levels with a marker.

    Take the first measurement from 250 us after the trigger, the second after 750 us, the third after 1220 us and so on for every 500 us until the table is filled.

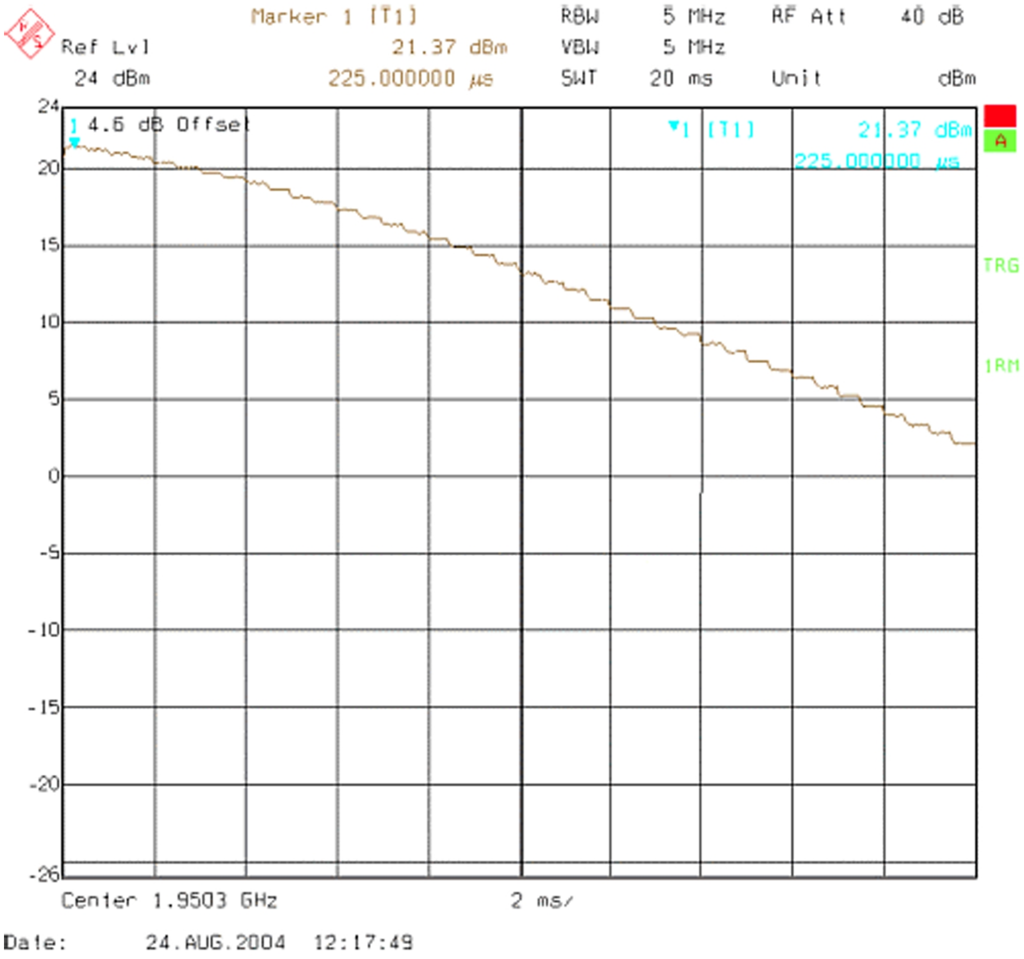


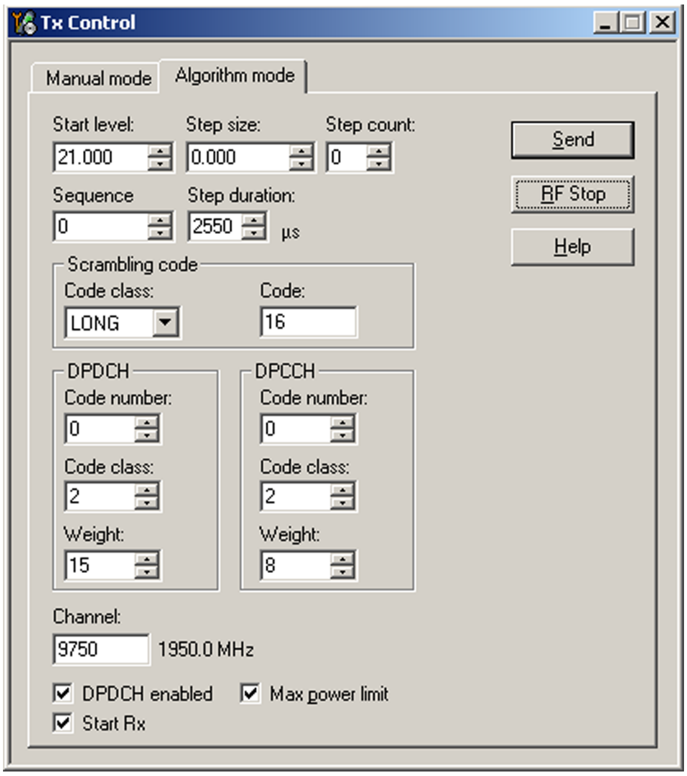
Figure 34 High burst measurement

13. In the *High Burst* pane, click **Calculate**.
14. Check that the calculated values are within the limits specified in the following table:

	Min	Max
C0-high	-0.5	5
C1-high	-50	50
C2-high	400	900
C0-mid	-0.7	0.7
C1-mid	0	50
C2-mid	400	900
C0-low	-4	4
C1-low	-400	440
C2-low	-10000	15000

	Min	Max
Det-k	100	220
Det-b	0	150

15. To save the coefficients to the phone, click **Write**.
16. To close the *Tx AGC & Power Detector* window, click **Close**.
17. Choose **Testing→WCDMA→ Tx Control.**
18. Select the *Algorithm* mode tab.



Start level: 21.000
Step size: 0.000
Step count: 0
Sequence: 0
Step duration: 2550 µs

Scrambling code
Code class: LONG
Code: 16

DPDCH
Code number: 0
Code class: 2
Weight: 15

DPCCH
Code number: 0
Code class: 2
Weight: 8

Channel: 9750 1950.0 MHz

☑ DPDCH enabled ☑ Max power limit
☑ Start Rx

19. Write the target power level 25 dBm to the *Start level* line and check the **Max power limit** check box (detector calibration check).
20. Setup the spectrum analyzer with the following settings:

Center frequency:	**1950.3 MHz (WCDMA I)** or **836.9 (WCDMA V)**
Span:	0 Hz
Reference level offset:	Cable attenuations + adapter attenuation
Reference level:	**24 dBm or -20 dBm depending on the level measured**
Input attenuation:	Automatic
Resolution bandwidth:	5 MHz
Video bandwidth:	5 MHz
Sweep time:	20 ms
Detector:	**RMS detector**

Average:	No
Trigger:	Free run

21. Click **Send**.
22. Measure the WCDMA output power.

    It should be around 21 dBm.
23. Click **RF Stop** and uncheck the **Max power limit** check box.
24. Repeat steps **19** to **23** for levels +19, +7, 0, -20 and –40 dBm.

    The measured output power may not differ more than +-2 dB from the requested value at level +19 dBm and no more than +-4 dB on lower levels.

    Remember to stop the RF before sending new data.

Alternative steps

- Measure the wide range levels normally and write down the levels that are possible to measure.
- Click **Finish**.
- Click **Options**.
- Change the first wide range DAC value to *573* and change the number of tuning steps to *21*.
- Change the spectrum analyzer reference level to *–20* dBm and adjust the input attenuator to the lowest value possible.
- In the *Wide Range* pane, click **Tune** and fill in the rest of values starting from the 19th level.

Tx band response calibration (WCDMA)

Context

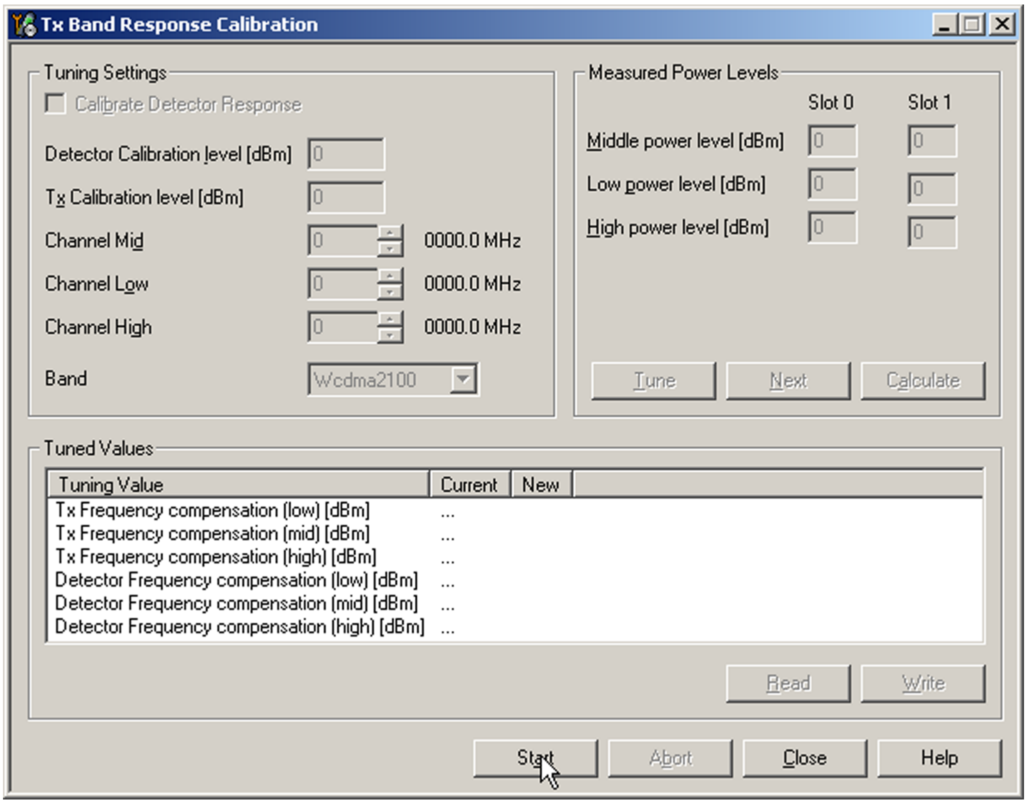
The purpose of this tuning operation is to calibrate the WCDMA Tx performance. It defines the power detector and Tx frequency compensation values. However, before starting this tuning procedure, it is necessary to carry out Tx AGC & Power Detector Calibration tuning. This is because its results will be needed for this tuning operation.

- In the *Tuning Settings* pane, it is possible to edit the numbers of channels used in this tuning operation.
- If the **Calibrate Detector Response** check box is checked, only Tx response is calibrated. Zero is written to the power detector compensation values block in the permanent memory (PM) of the terminal.
- **Detector Calibration level** shows the power level used for calibrating the power detector in this tuning procedure.
- **Tx Calibration level** shows the power level used for calibrating tx frequency in this tuning procedure.
- In the *Measured Power Levels* pane, you can insert the dBm values read from the power meter.
- In the *Tuned Values* pane, the values that are stored in the permanent memory (PM) of the terminal in Current columns are shown.
- New values are added to *New* column when the **Calculate** button is clicked.
- The **Abort** button aborts the tuning operation without saving the tuned values.
- The **Read** button reads the tuned values in the PM of the terminal, and displays them in the *Tuned Values* pane in in the *Current* column.

Steps

1. Start *Phoenix* service software.
2. Choose **File→Scan Product** .

3. From the **Operating mode** drop-down menu, set mode to **Local**.
4. Choose **Tuning→WCDMA→Tx Band Response Calibration** .
5. Click **Start**.


Tx Band Response Calibration
Tuning Settings
☐ Calibrate Detector Response
Measured Power Levels
Tune
Next
Calculate
Tuned Values
Read
Write
Start
Abort
Close
Help

Detector Calibration level [dBm] 0
Tx Calibration level [dBm] 0
Channel Mid 0 0000.0 MHz
Channel Low 0 0000.0 MHz
Channel High 0 0000.0 MHz
Band Wcdma2100

	Slot 0	Slot 1
Middle power level [dBm]	0	0
Low power level [dBm]	0	0
High power level [dBm]	0	0

Tuning Value	Current	New
Tx Frequency compensation (low) [dBm]	...	
Tx Frequency compensation (mid) [dBm]	...	
Tx Frequency compensation (high) [dBm]	...	
Detector Frequency compensation (low) [dBm]	...	
Detector Frequency compensation (mid) [dBm]	...	
Detector Frequency compensation (high) [dBm]	...	

The current values are shown in the *Tuned Values* pane.

6. Click **Tune**.
7. Connect the power meter to the terminal, and set it to **Channel Mid** frequency.
8. Read the values of slot 0 and slot 1 from the power meter and enter them to **Middle power level** fields in the **Measured Power Levels** pane.

   Slot 0 is used for detector calibration and slot 1 for Tx calibration.
9. Click **Next**.
10. Switch the power meter to **Channel Low** frequency.
11. Read the values from the power meter, and enter them to **Low power level** fields.
12. Switch the power meter to **Channel High** frequency.
13. Read the values from the power meter, and enter them to **High power level** fields.
14. Click **Next**.
15. Click **Calculate**.

    The tuned values are shown in the *Tuned Values* pane in the *New* column.
16. Check that the tuned values are within the limits presented in the following table. If they are OK, click **Yes**.

	Min	Max
Tx Freq Comp (the first and last value)	-4	+4

17. To save the tuned values to the terminal, click **Write**.
18. Close the *Tx Band Response Calibration* window.

Tx LO leakage (WCDMA)

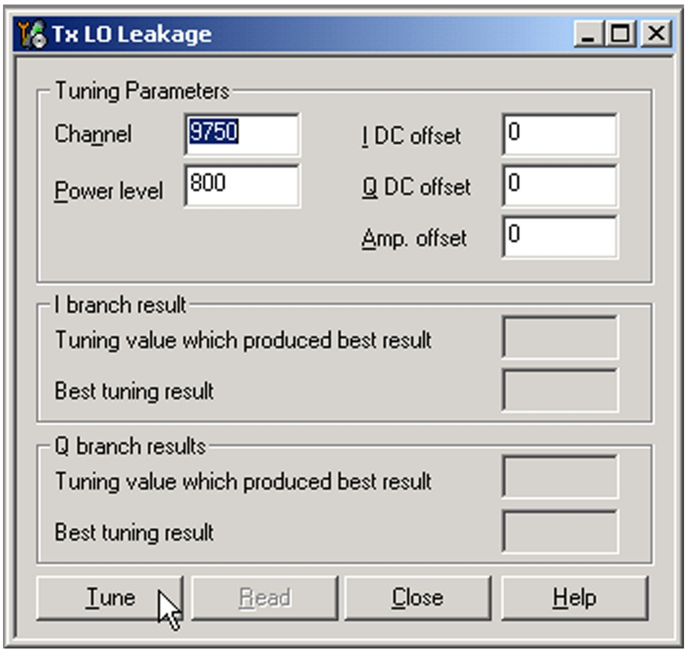
Context

The purpose of Tx LO leakage tuning is to minimize the carrier leakage of the IQ-modulator which is caused by the DC offset voltages in the Tx IQ-signal lines and in the actual IQ modulator.

The tuning improves WCDMA Tx AGC dynamics at low power levels. A self-calibration routine selects the best combination for internal control words in order to produce minimum LO leakage.

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning**→**WCDMA**→ **Tx LO Leakage** .
3. Click **Tune**.


Tx LO Leakage
Tuning Parameters
I branch result
Tuning value which produced best result
Best tuning result
Q branch results
Tuning value which produced best result
Best tuning result
Tune
Read
Close
Help

Channel: 9750
Power level: 800
I DC offset: 0
Q DC offset: 0
Amp. offset: 0

4. To end the tuning, click **Close**.

(This page left intentionally blank.)

5 — Camera Module Troubleshooting

(This page left intentionally blank.)

Table of Contents

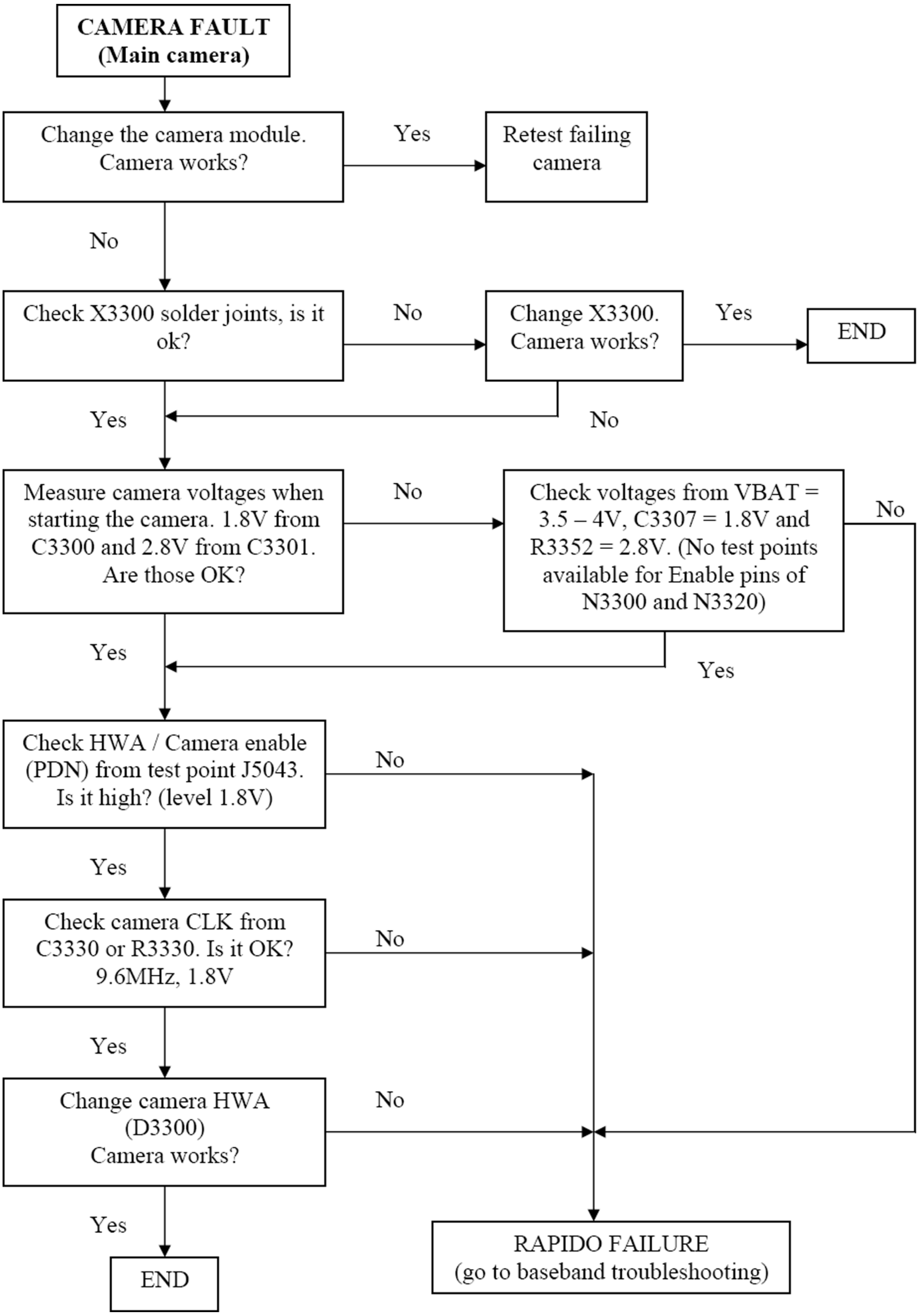
Main (back) camera troubleshooting 5–5
  Main camera troubleshooting 5–5
  Camera flash LED troubleshooting 5–6
Secondary (front) camera troubleshooting 5–7
  Secondary camera troubleshooting 5–7
Camera hardware failure troubleshooting 5–8

(This page left intentionally blank.)

Main (back) camera troubleshooting

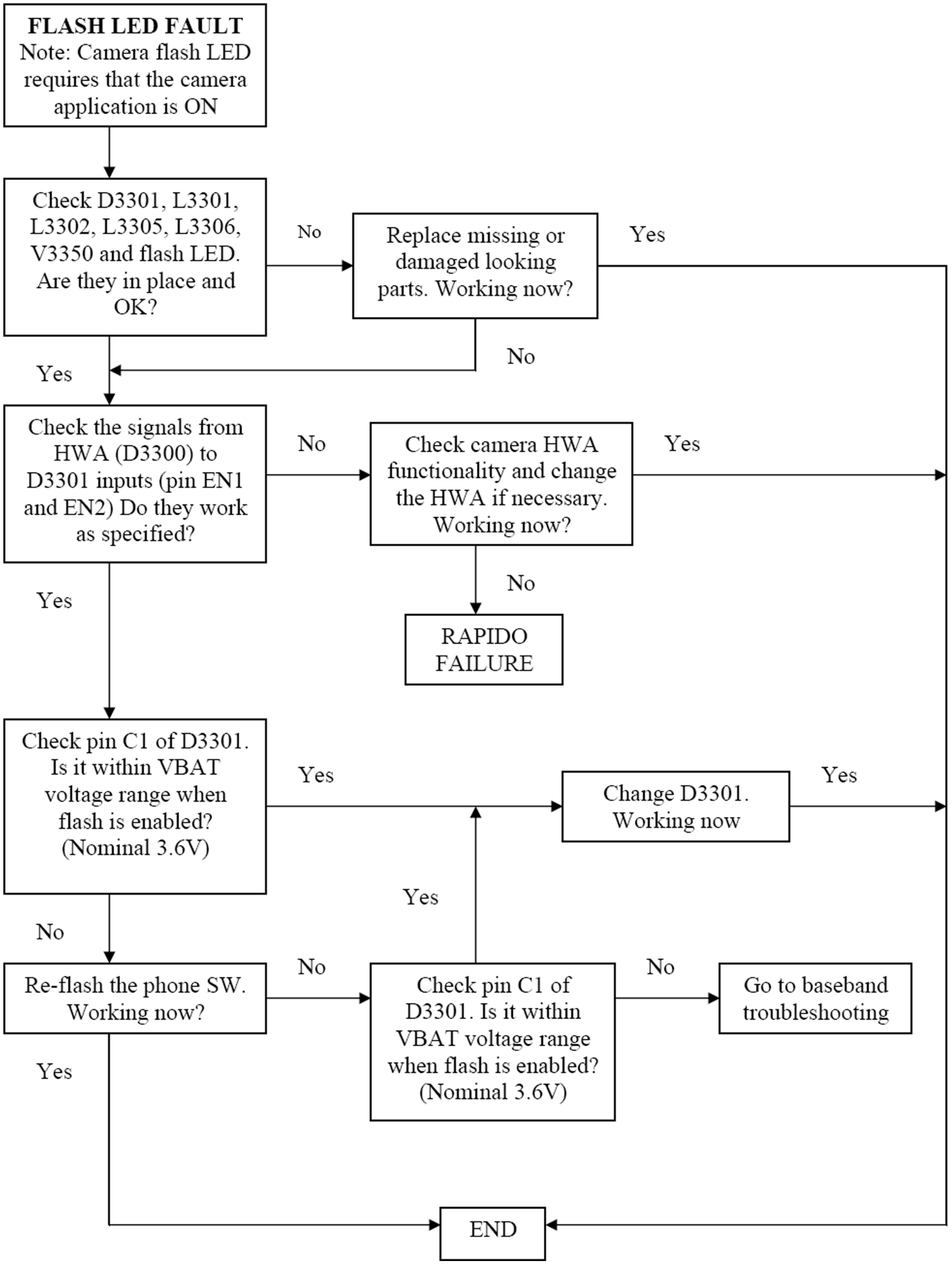
Main camera troubleshooting

Troubleshooting flow


CAMERA FAULT (Main camera)
Change the camera module. Camera works?
Yes
Retest failing camera
No
Check X3300 solder joints, is it ok?
No
Change X3300. Camera works?
Yes
END
Yes
No
Measure camera voltages when starting the camera. 1.8V from C3300 and 2.8V from C3301. Are those OK?
No
Check voltages from VBAT = 3.5 – 4V, C3307 = 1.8V and R3352 = 2.8V. (No test points available for Enable pins of N3300 and N3320)
No
Yes
Yes
Check HWA / Camera enable (PDN) from test point J5043. Is it high? (level 1.8V)
No
Yes
Check camera CLK from C3330 or R3330. Is it OK? 9.6MHz, 1.8V
No
Yes
Change camera HWA (D3300) Camera works?
No
Yes
END
RAPIDO FAILURE (go to baseband troubleshooting)

Camera flash LED troubleshooting

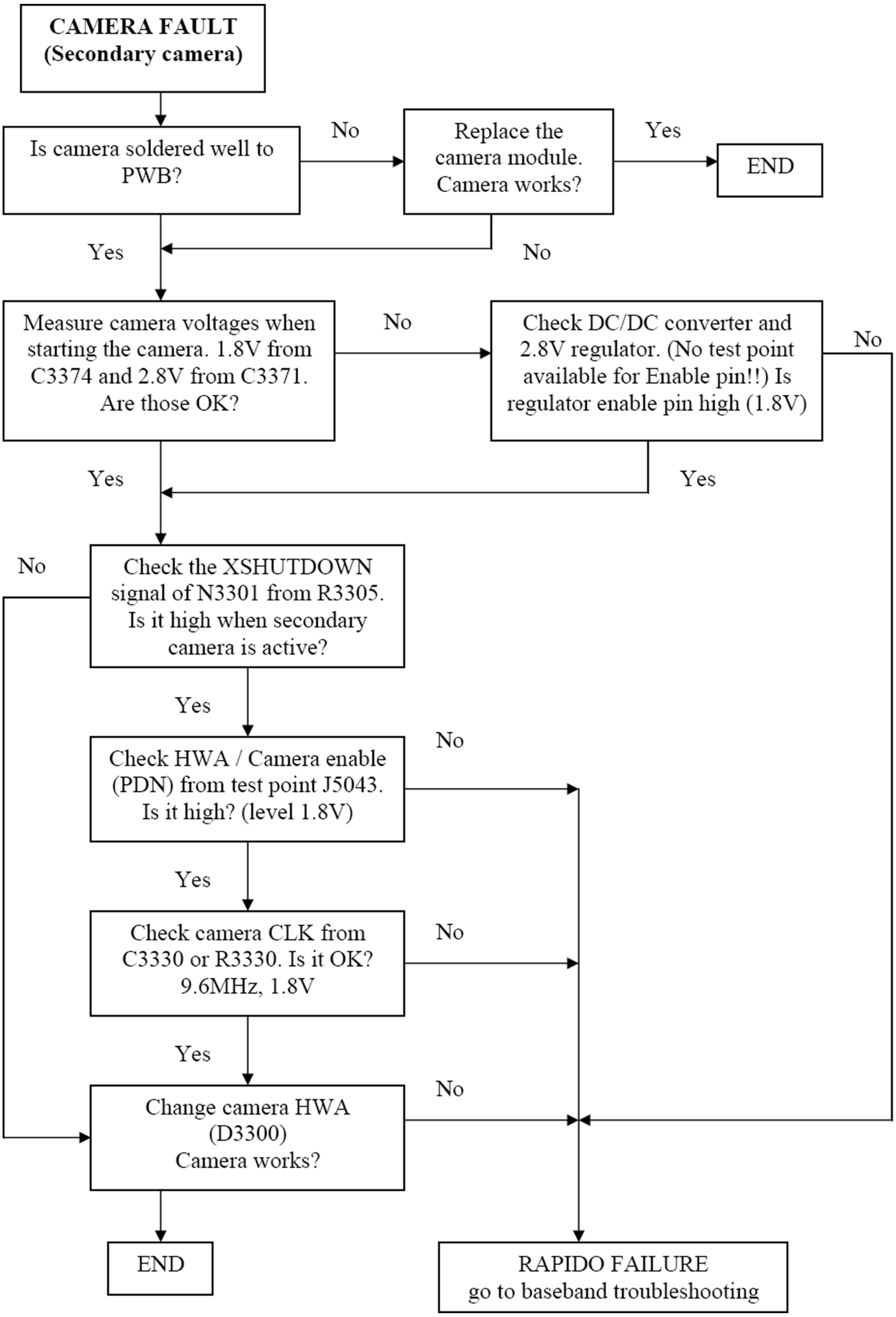
Troubleshooting flow


FLASH LED FAULT
Note: Camera flash LED requires that the camera application is ON
Check D3301, L3301, L3302, L3305, L3306, V3350 and flash LED. Are they in place and OK?
No
Replace missing or damaged looking parts. Working now?
Yes
No
Yes
Check the signals from HWA (D3300) to D3301 inputs (pin EN1 and EN2) Do they work as specified?
No
Check camera HWA functionality and change the HWA if necessary. Working now?
Yes
No
RAPIDO FAILURE
Yes
Check pin C1 of D3301. Is it within VBAT voltage range when flash is enabled? (Nominal 3.6V)
Yes
Change D3301. Working now
Yes
Yes
No
Re-flash the phone SW. Working now?
No
Check pin C1 of D3301. Is it within VBAT voltage range when flash is enabled? (Nominal 3.6V)
No
Go to baseband troubleshooting
Yes
END

Secondary (front) camera troubleshooting

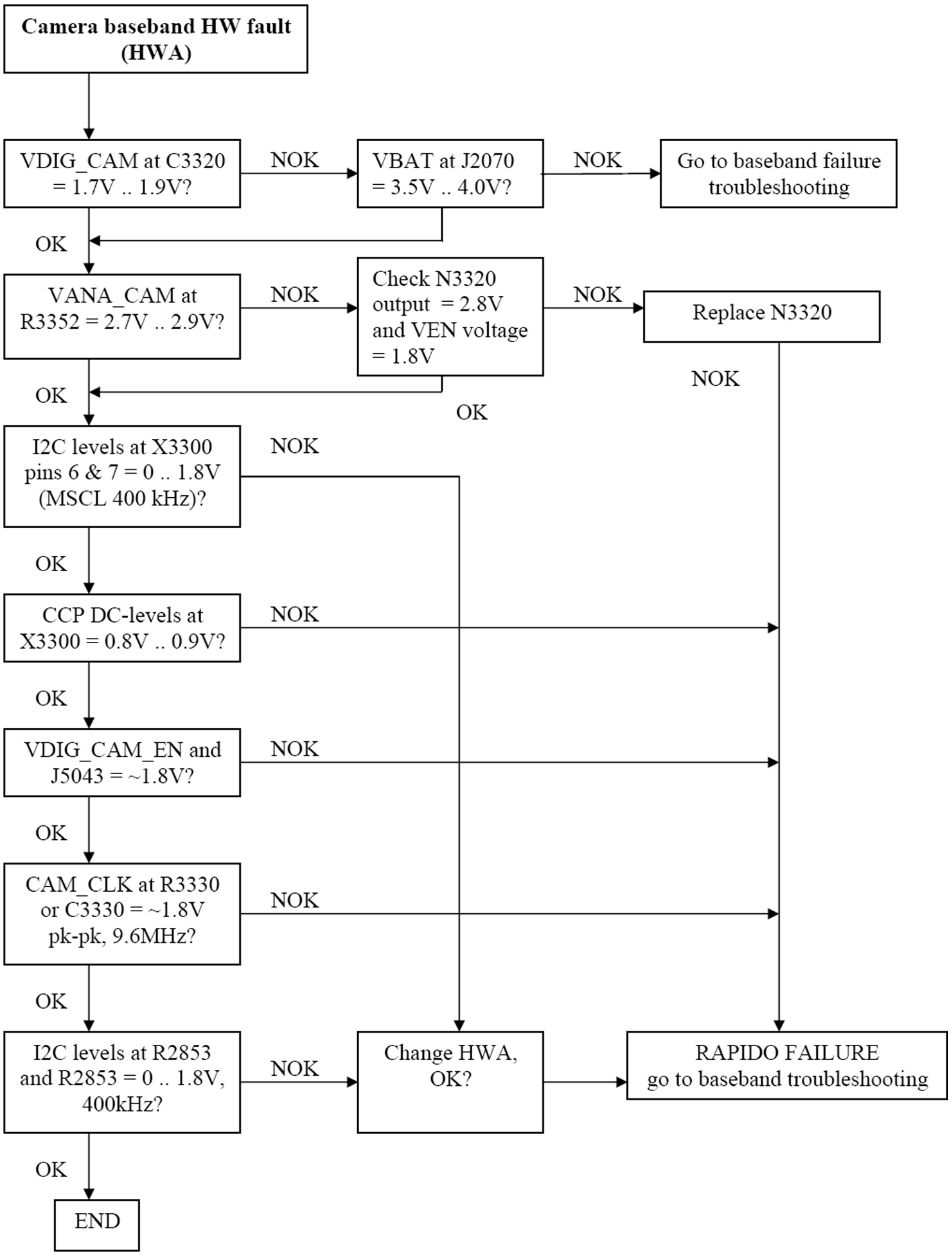
Secondary camera troubleshooting

Troubleshooting flow


CAMERA FAULT (Secondary camera)
Is camera soldered well to PWB?
No
Replace the camera module. Camera works?
Yes
END
No
Yes
Measure camera voltages when starting the camera. 1.8V from C3374 and 2.8V from C3371. Are those OK?
No
Check DC/DC converter and 2.8V regulator. (No test point available for Enable pin!!) Is regulator enable pin high (1.8V)
No
Yes
Yes
No
Check the XSHUTDOWN signal of N3301 from R3305. Is it high when secondary camera is active?
Yes
Check HWA / Camera enable (PDN) from test point J5043. Is it high? (level 1.8V)
No
Yes
Check camera CLK from C3330 or R3330. Is it OK? 9.6MHz, 1.8V
No
Yes
Change camera HWA (D3300) Camera works?
No
END
RAPIDO FAILURE go to baseband troubleshooting

Camera hardware failure troubleshooting

Troubleshooting flow


Camera baseband HW fault (HWA)
VDIG_CAM at C3320 = 1.7V .. 1.9V?
NOK
VBAT at J2070 = 3.5V .. 4.0V?
NOK
Go to baseband failure troubleshooting
OK
VANA_CAM at R3352 = 2.7V .. 2.9V?
NOK
Check N3320 output = 2.8V and VEN voltage = 1.8V
NOK
Replace N3320
NOK
OK
OK
I2C levels at X3300 pins 6 & 7 = 0 .. 1.8V (MSCL 400 kHz)?
NOK
OK
CCP DC-levels at X3300 = 0.8V .. 0.9V?
NOK
OK
VDIG_CAM_EN and J5043 = ~1.8V?
NOK
OK
CAM_CLK at R3330 or C3330 = ~1.8V pk-pk, 9.6MHz?
NOK
OK
I2C levels at R2853 and R2853 = 0 .. 1.8V, 400kHz?
NOK
Change HWA, OK?
RAPIDO FAILURE go to baseband troubleshooting
OK
END

6 — System Module and User Interface

(This page left intentionally blank.)

Table of Contents

Introduction 6–5
  Phone description 6–5
Energy management 6–6
  Battery and charging 6–6
  Backup battery 6–8
  Normal and extreme voltages 6–8
  Power key and system power-up 6–9
  Modes of operation 6–9
  Power distribution 6–10
  Clocking scheme 6–10
Bluetooth 6–11
FM radio 6–12
USB 6–13
CBUS interface 6–13
FBUS 6–13
ECI interface 6–13
Charger interface 6–13
SIM interface 6–13
µSD card interface 6–14
Camera concept 6–15
  Cameras 6–15
  Main camera characteristics 6–15
  Camera flash 6–15
  Secondary camera characteristics 6–16
User interface 6–16
  Display module 6–16
  Keyboard and other keys 6–17
  Display and keypad backlight 6–18
ASICs 6–18
  RAP ASIC 6–18
  EM ASIC N2300 (Betty) 6–18
  EM ASIC N2200 (Avilma) 6–18
Device memories 6–18
  RAP memories NOR flash and SDRAM 6–18
  Combo memory 6–19
Audio concept 6–19
  Audio HW architecture 6–19
  Internal microphone 6–19
  External microphone 6–20
  Internal earpiece 6–20
  Internal speaker 6–21
  External earpiece 6–21
  Vibra circuitry 6–22
  AV connector 6–22
Baseband technical specifications 6–23
  External interfaces 6–23
  SIM IF connections 6–23
  Charging interface connections & electrical characteristics 6–24
  Internal interfaces 6–24
  Back-up battery interface electrical characteristics 6–24

RF description 6–25
    Block diagram 6–25
    Receiver (RX) 6–25
    Transmitter (TX) 6–26
Frequency mappings 6–27
    GSM850 frequencies 6–27
    EGSM900 frequencies 6–27
    GSM1800 frequencies 6–28
    GSM1900 frequencies 6–30
    WCDMA V (850) frequencies 6–31
    WCDMA 2100 Rx frequencies 6–32
    WCDMA 2100 Tx frequencies 6–33

List of Tables

Table 14 Nominal voltages 6–8
Table 15 AV interface electrical characteristics 6–22
Table 16 Charging interface connections 6–24
Table 17 Charging IF electrical characteristics 6–24
Table 18 Back-up battery connections 6–24
Table 19 Back-up battery electrical characteristics 6–25

List of Figures

Figure 35 Battery pin order 6–7
Figure 36 LYNX battery connector 6–7
Figure 37 Small (left) and wide (right) charger plugs 6–8
Figure 38 Clocking scheme 6–11
Figure 39 Bluetooth interface 6–12
Figure 40 FM interface 6–12
Figure 41 SIM interface 6–14
Figure 42 Camera flash and driver design 6–16
Figure 43 Keyboard layout 6–17
Figure 44 Audio block diagram 6–19
Figure 45 Internal microphone circuitry 6–20
Figure 46 External earpiece and microphone circuitry (AV connected on the right) 6–20
Figure 47 Internal earpiece circuitry 6–21
Figure 48 Internal speaker circuitry 6–21
Figure 49 External earpiece and microphone circuitry (AV connected on the right) 6–22
Figure 50 Vibra circuitry 6–22
Figure 51 RF block diagram using RF ASIC N7505 6–25

Introduction

Phone description

RapidoYawe is the main digital baseband ASIC in the phone. It contains functionality for both WCDMA and GSM EDGE.

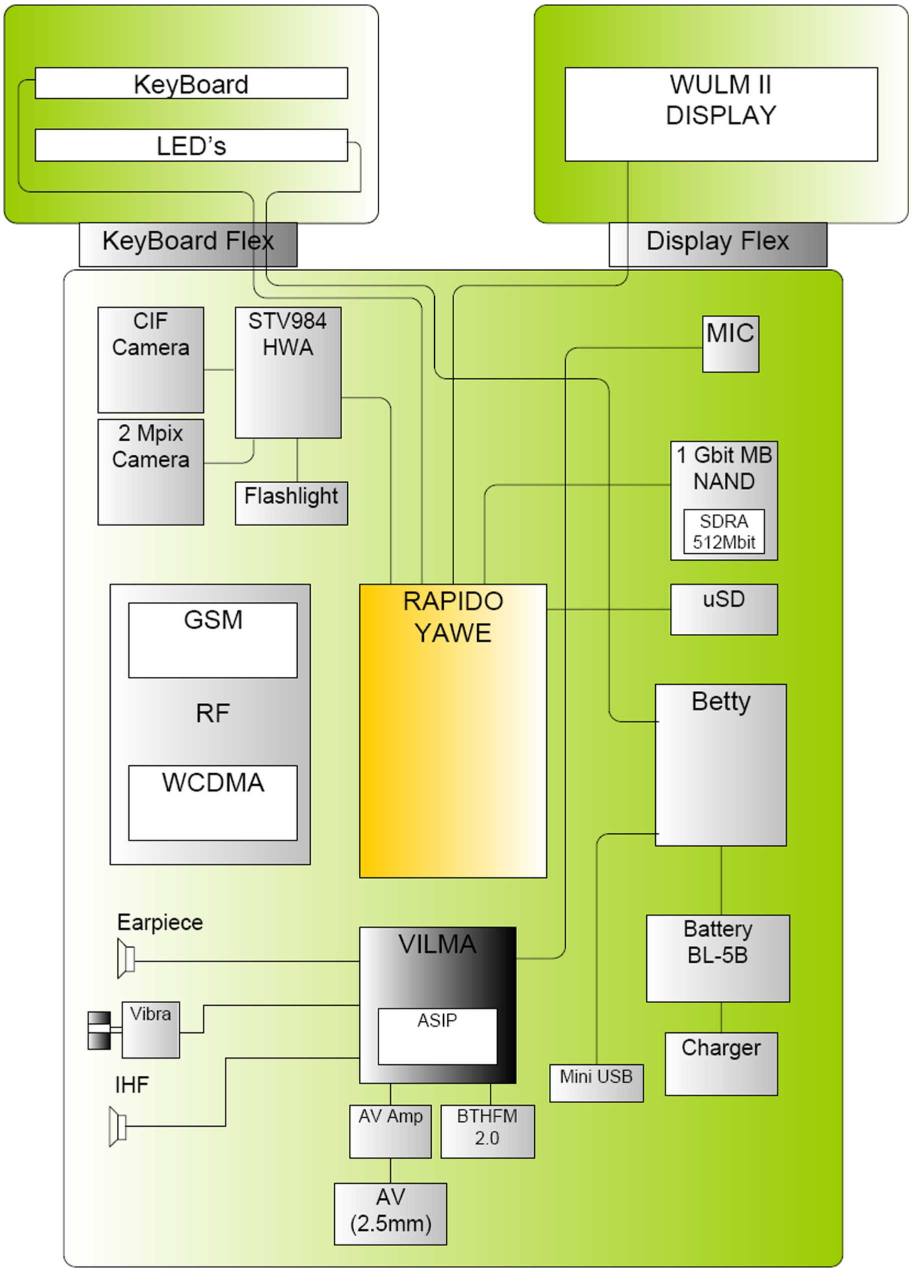
Avilma is mainly the audio ASIC in the phone and Betty is basically the energy management controller for the phone.

Bluetooth and FM radio are physically integrated in one single ASIC.

Key components

Function	Description	Item ref
Baseband ASIC	Avilma Betty	N2200 N2300
RF ASIC	Ahneus	N7505
Processor	RapidoYawe	D2800
Camera accelerator	HWA STV984N	D3300
PA GSM	Front end module (FEM), quad band	N7520
PA WCDMA		N7540
Oscillators	VCTCXO 32.768 kHz crystall oscillator	G7501 B2200
Memory	512Mb DDR SDRAM + 1Gb M3 Nand FLASH Combo	D3000
Back-up battery	RTC back-up battery 311	G2200
FM radio	BTFMRDS2.0D chip	N6000
Bluetooth	BTFMRDS2.0D chip	N6000
Battery	BL-5B	
Battery connector	LYNX	X2070
RF connector		X7501

System module block diagram


KeyBoard
LED's
KeyBoard Flex
WULM II DISPLAY
Display Flex
CIF Camera
STV984 HWA
2 Mpix Camera
Flashlight
MIC
1 Gbit MB NAND
SDRA 512Mbit
uSD
GSM
RF
WCDMA
RAPIDO YAWE
Betty
Earpiece
VILMA
ASIP
Vibra
IHF
Battery BL-5B
Charger
Mini USB
AV Amp
BTHFM 2.0
AV (2.5mm)

Energy management

Battery and charging

BL-5B battery

The phone is powered by a 3-pole BL-5B S-pack 890 mAh battery. The three poles are named VBAT, BSI and GND where the BSI line is used to recognize the battery capacity. This is done by means of an internal battery pull down resistor.

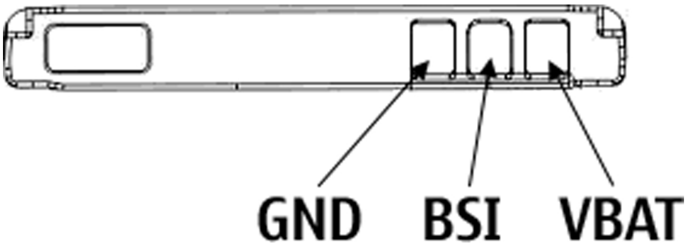


Figure 35 Battery pin order

The battery temperature is estimated by measuring separate battery temperature NTC via the BTEMP line. This is located on the main PWB, at the place where the phone temperature is closest to the battery temperature.

Battery connector

The battery connector is a LYNX connector. It has three contacts;

- BSI (Battery size indicator)
- GND (Ground)
- VBAT (Battery voltage)

The BSI line is used to recognize the battery capacity by a battery internal pull down resistor.

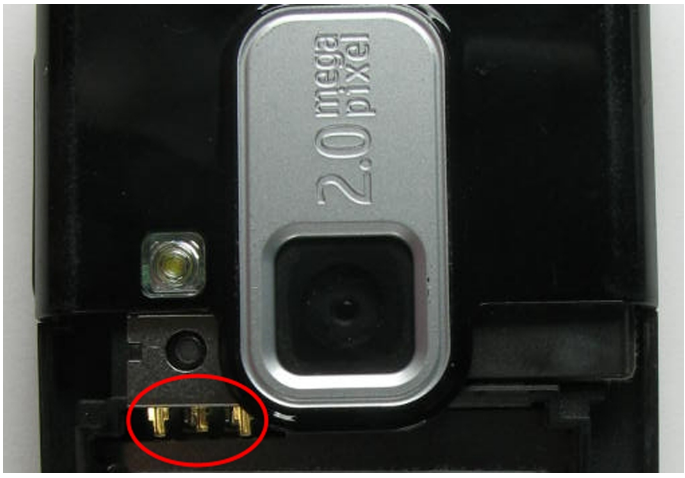


Figure 36 LYNX battery connector

Charging

This phone is charged through the smaller Nokia standard interface (2.0 mm plug). The wider standard charger (3.5 mm) can be used together with the CA-44 charger adapter.

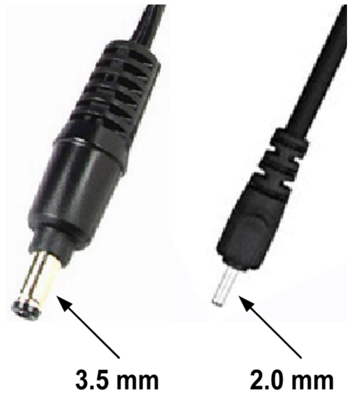


Figure 37 Small (left) and wide (right) charger plugs

Charging is controlled by energy management, and external components are needed to protect the baseband module against EMC, reverse polarity and transient frequency deviation.

Backup battery

When the main battery is not attached EM ASIC (N2200) goes in backup mode using back-up battery that supplies voltage to RTC in EM ASIC (N2200).

Normal and extreme voltages

Energy management is mainly carried out in the two Application Specific Integrated Circuits (ASICs) BETTY and AVILMA. These two circuits contains a number of regulators. In addition there are some external regulators too.

In the table below normal and extreme voltages are shown when a BL-5B S-pack battery is used.

Table 14 Nominal voltages

Voltage	Voltage [V]	Condition
General Conditions		
Nominal voltage	3.700	
Lower extreme voltage	3.145	
Higher extreme voltage (fast charging)	4.230	
HW Shutdown Voltages		
Vmstr+	2.1 ± 0.1	Off to on
Vmstr-	1.9 ± 0.1	On to off
SW Shutdown Voltages		
Sw shutdown	3.1	In call
Sw shutdown	3.2	In idle
Min Operating Voltage		
Vcoff+	2.9 ± 0.1	Off to on
Vcoff-	2.6 ± 0.1	On to off

Power key and system power-up

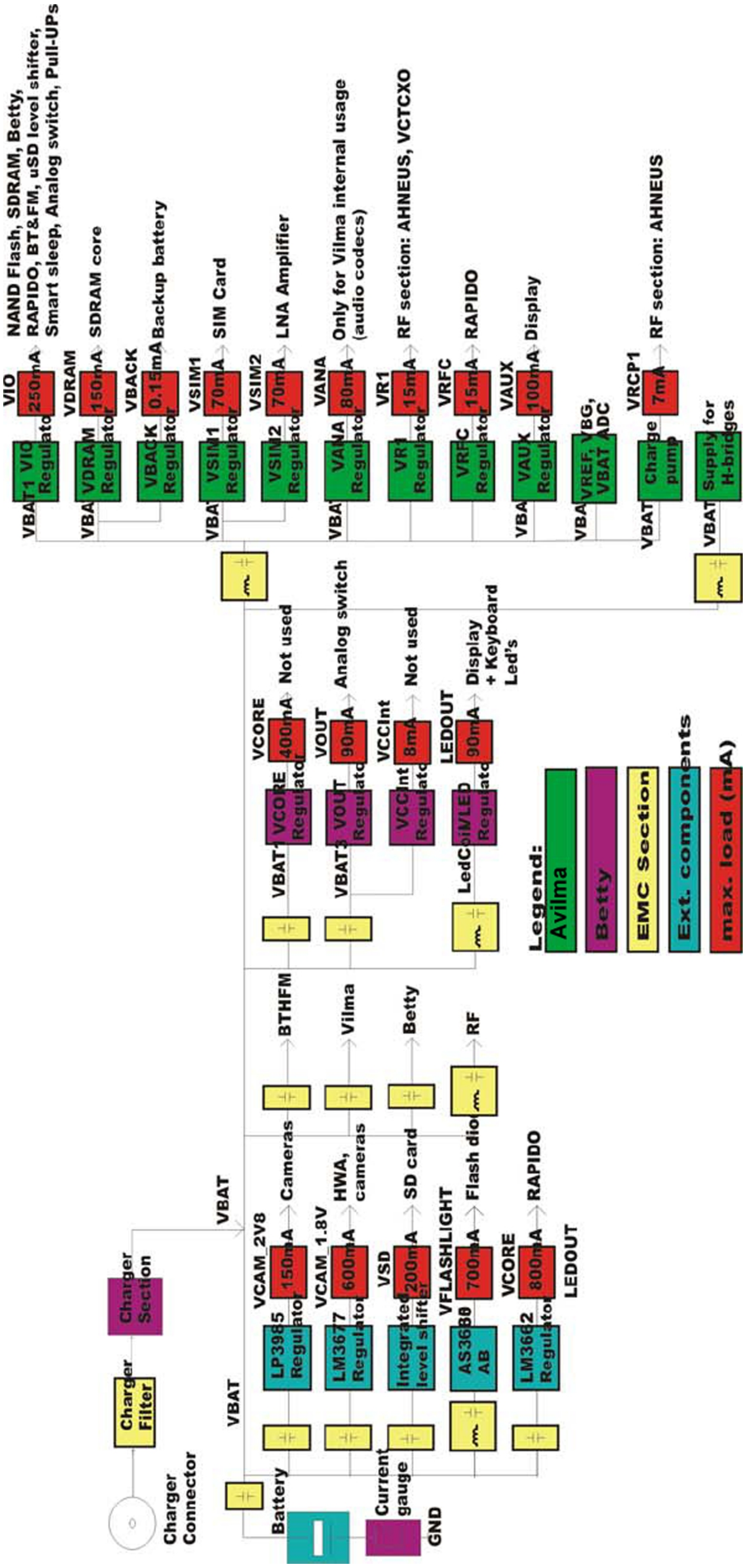
When the battery is placed in the phone the power key circuits are energized. When the power key is pressed, the system boots up (if an adequate battery voltage is present).

Power down can be initiated by pressing the power key again (the system is powered down with the aid of SW). The power key is connected to EM ASIC N2200 (AVILMA) via PWRONX signal.

Modes of operation

Mode	Description
NO_SUPPLY	(dead) mode means that the main battery is not present or its voltage is too low (below N2200 AVILMA master reset threshold) and that the back-up battery voltage is too low.
BACK_UP	The main battery is not present or its voltage is too low but back-up battery voltage is adequate and the 32 kHz oscillator is running (RTC is on).
PWR_OFF	In this mode (warm), the main battery is present and its voltage is over N2300 BETTY master reset threshold. All regulators are disabled, PurX is on low state, the RTC is on and the oscillator is on. PWR_OFF (cold) mode is almost the same as PWR_OFF (warm), but the RTC and the oscillator are off.
RESET	RESET mode is a synonym for start-up sequence. RESET mode uses 32 kHz clock to count the REST mode delay (typically 16ms).
SLEEP	SLEEP mode is entered only from PWR_ON mode with the aid of SW when the system's activity is low.
FLASHING	FLASHING mode is for SW downloading.

Power distribution


VBAT1 VIO Regulator
VIO
250mA
NAND Flash, SDRAM, Betty, RAPIDO, BT&FM, uSD level shifter, Smart sleep, Analog switch, Pull-UPs
VBAT VDRAM Regulator
VDRAM
150mA
SDRAM core
VBACK Regulator
VBACK
0.15mA
Backup battery
VBAT VSIM1 Regulator
VSIM1
70mA
SIM Card
VSIM2 Regulator
VSIM2
70mA
LNA Amplifier
VBAT VANA Regulator
VANA
80mA
Only for Vilma internal usage (audio codecs)
VR1 Regulator
VR1
15mA
RF section: AHNEUS, VCTCXO
VRFC Regulator
VRFC
15mA
RAPIDO
VBAT VAUX Regulator
VAUX
100mA
Display
VBAT VREF, VBG, VBAT ADC
VBAT Charge pump
VRCP1
7mA
RF section: AHNEUS
VBAT Supply for H-bridges
VBAT1 VCORE Regulator
VCORE
400mA
Not used
VBAT3 VOUT Regulator
VOUT
90mA
Analog switch
VCCInt Regulator
VCCInt
8mA
Not used
LedCoil VLED Regulator
LEDOUT
90mA
Display + Keyboard Led's
BTHFM
Vilma
Betty
RF
Legend:
Avilma
Betty
EMC Section
Ext. components
max. load (mA)
Charger Connector
Charger Filter
Charger Section
VBAT
VBAT
Battery
Current gauge
GND
LP3985 Regulator
VCAM_2V8
150mA
Cameras
LM3677 Regulator
VCAM_1.8V
600mA
HWA, cameras
Integrated level shifter
VSD
200mA
SD card
AS3638 AB
VFLASHLIGHT
700mA
Flash diode
LM3662 Regulator
VCORE
800mA
RAPIDO
LEDOUT

Clocking scheme

In BB5, two main clocks are provided to the system: 38.4MHz RF clock produced by VCTCXO in RF section and 32.768kHz sleep clock produced by AVILMA with an external crystal.

32 k Sleep Clock is always powered on after startup. Sleep clock is used by RAPIDO for low-power operation.

SMPS Clk is 2.4 MHz clock line from RAPIDO to BETTY. In deep sleep mode, when VCTCXO is off, this signal is set to '0'-state.

BT Clk is 38.4 MHz signal from AHNEUS ASIC to BT module.

CLK600. The clock source is internal RC oscillator in BETTY (during the power-up sequence) or RAPIDO SMPS Clk.

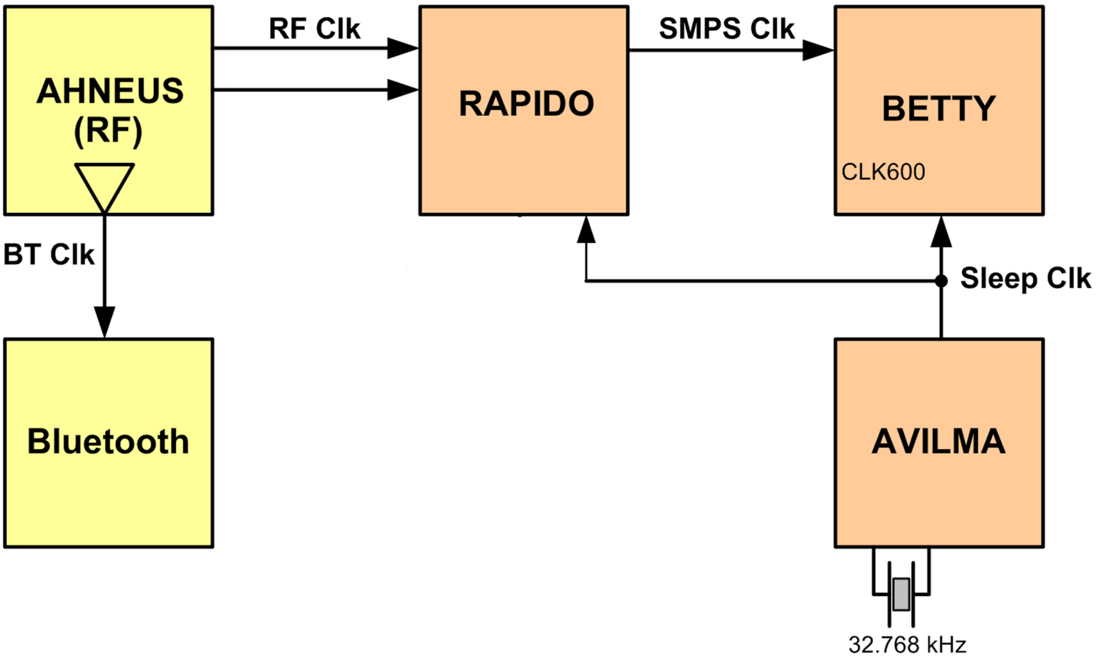


Figure 38 Clocking scheme

Bluetooth

Bluetooth provides a fully digital link for communication between a master unit (the phone) and one or more slave units (e.g. a wireless headset). Data and control interface for a low power RF module is provided by the module.

The Bluetooth is physically integrated with the FM radio into a discrete module. From a functional point of view they, however, have nothing in common.

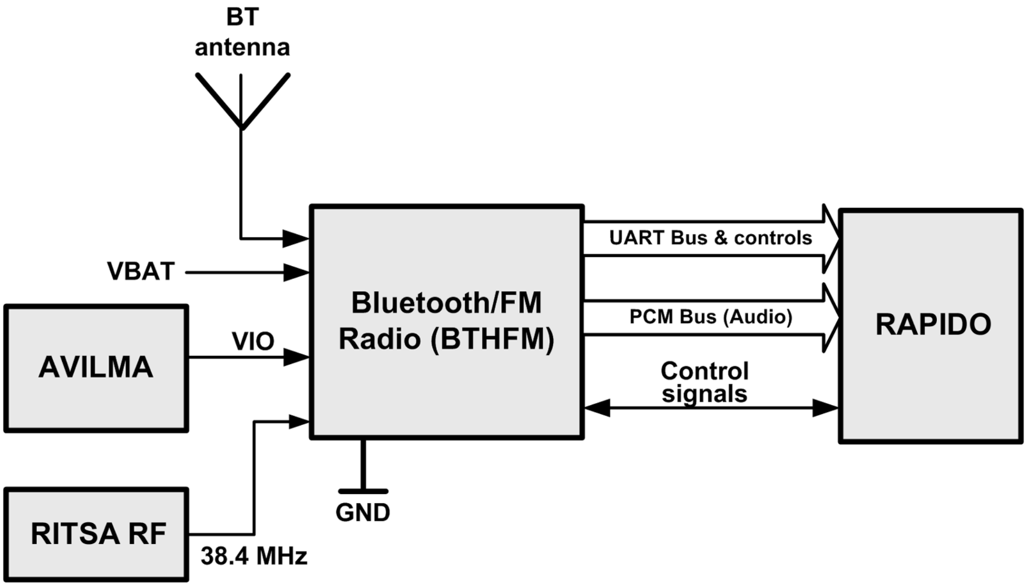

BT antenna
VBAT
AVILMA
VIO
RITSA RF
38.4 MHz
Bluetooth/FM Radio (BTHFM)
GND
UART Bus & controls
PCM Bus (Audio)
Control signals
RAPIDO

Figure 39 Bluetooth interface

The Bluetooth has a separate built in antenna and is powered by VBAT and the regulated voltage VIO. For audio applications the Bluetooth has a PCM data bus. In addition a UART (universal asynchronous receiver/transmitter) is used for data communication and controls.

FM radio

The FM radio is physically integrated with the Bluetooth into one single module. From a functional point of view they, however, have nothing in common.

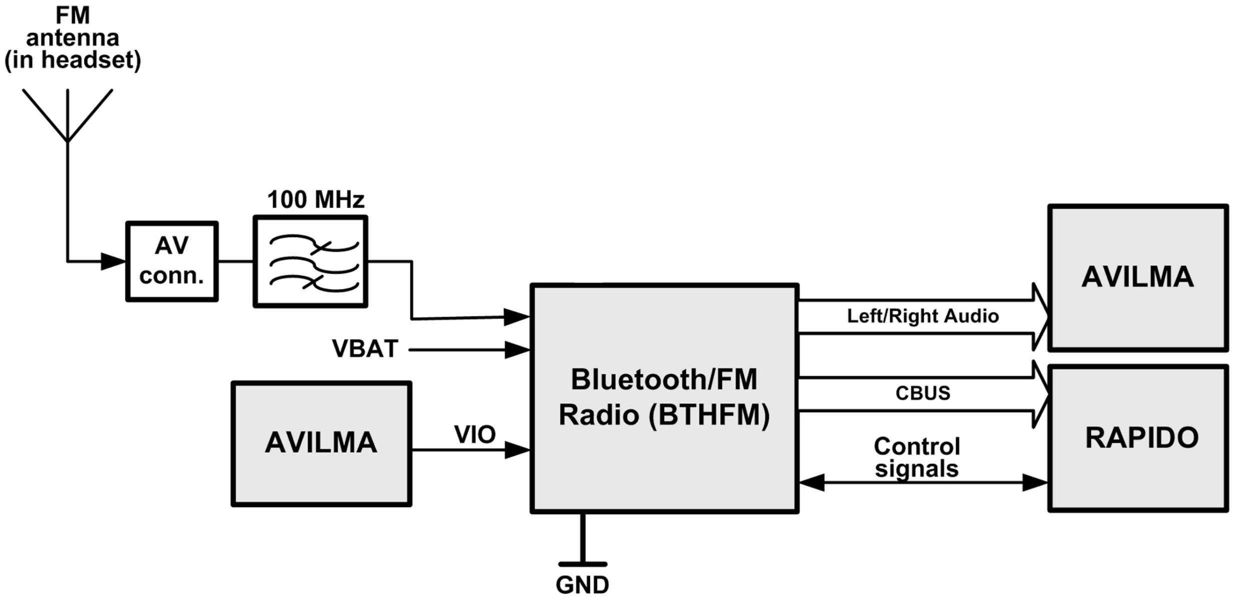

FM antenna (in headset)
AV conn.
100 MHz
VBAT
AVILMA
VIO
Bluetooth/FM Radio (BTHFM)
GND
Left/Right Audio
CBUS
Control signals
AVILMA
RAPIDO

Figure 40 FM interface

The FM radio is an integrated circuit, controlled by MCU software through a serial bus interface. The wires of the headset are used as elements of the antenna, and no other antenna is needed for FM radio reception.

The radio has an automatic band search function, which can search for a strong station.

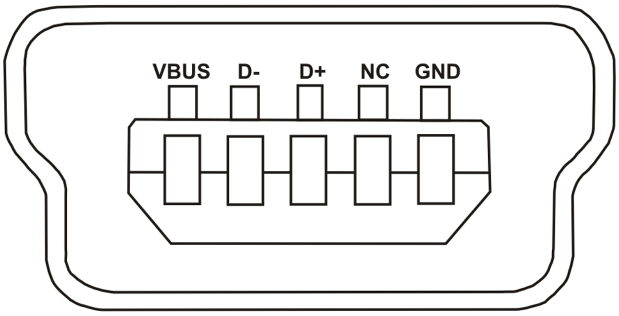
USB

USB (Universal Serial Bus) provides a wired connectivity between a PC and peripheral devices. It is a differential serial bus.

USB 2.0 is supported with full speed (12 Mbps).

Hot swap is supported, which means that USB devices may be plugged in/out at any time.

This phone is provided with a specific connector for mini USB.



CBUS interface

CBUS is a "main" system control bus in BB5. RAPIDO controls the functionality of EM ASIC (N2200) and EM ASIC (N2300) ASICs with CBUS.

CBUS is a four-wire half-duplex master-slave interface. In BB5 CBUS clock frequency is 2.4 MHz.

FBUS

USB and FBUS have multiplexed interface between EM ASIC (2300) and RAPIDO.

ECI interface

The ECI (Enhancement Control Interface) is a point-to-point, bi-directional, single line serial bus.

The purpose of the ECI is to identify and authenticate the accessory, and to act as a data bus (intended for control purposes) between the phone and the accessory .

Charger interface

Charging control and charge switch are situated in EM ASIC (N2300).

If the temperature rises too high and the thermal protection is activated, EM ASIC (N2300) goes to protection mode.

SIM interface

The device has one SIM (Subscriber Identification Module) interface. It is only accessible if battery is removed. The SIM interface consists of an internal interface between RAPIDO and EM ASIC (N2200), and of an external interface between N2200 and SIM contacts.

The SIM IF is shown in the following figure:

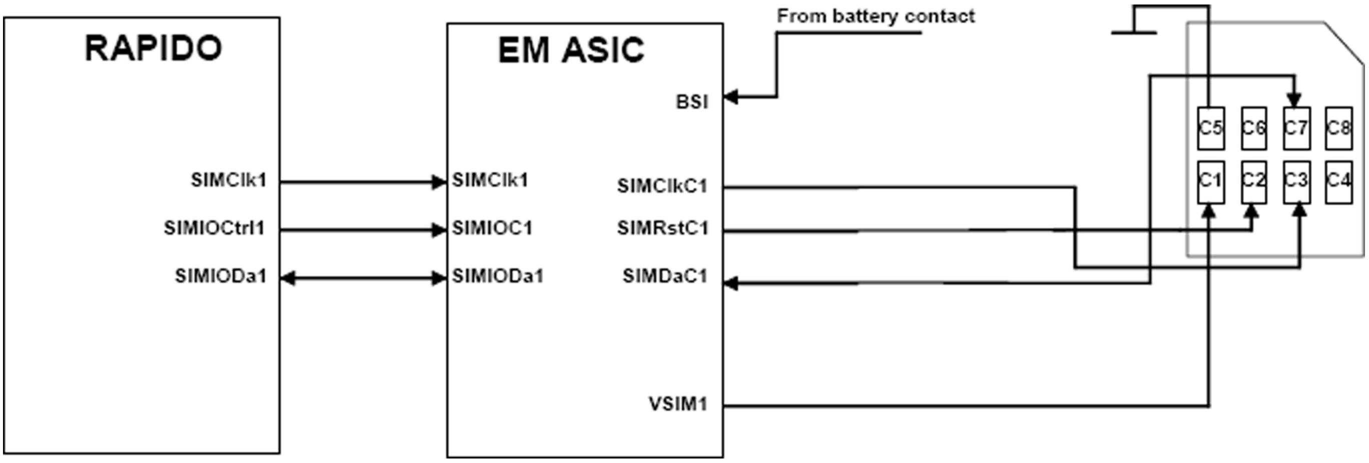
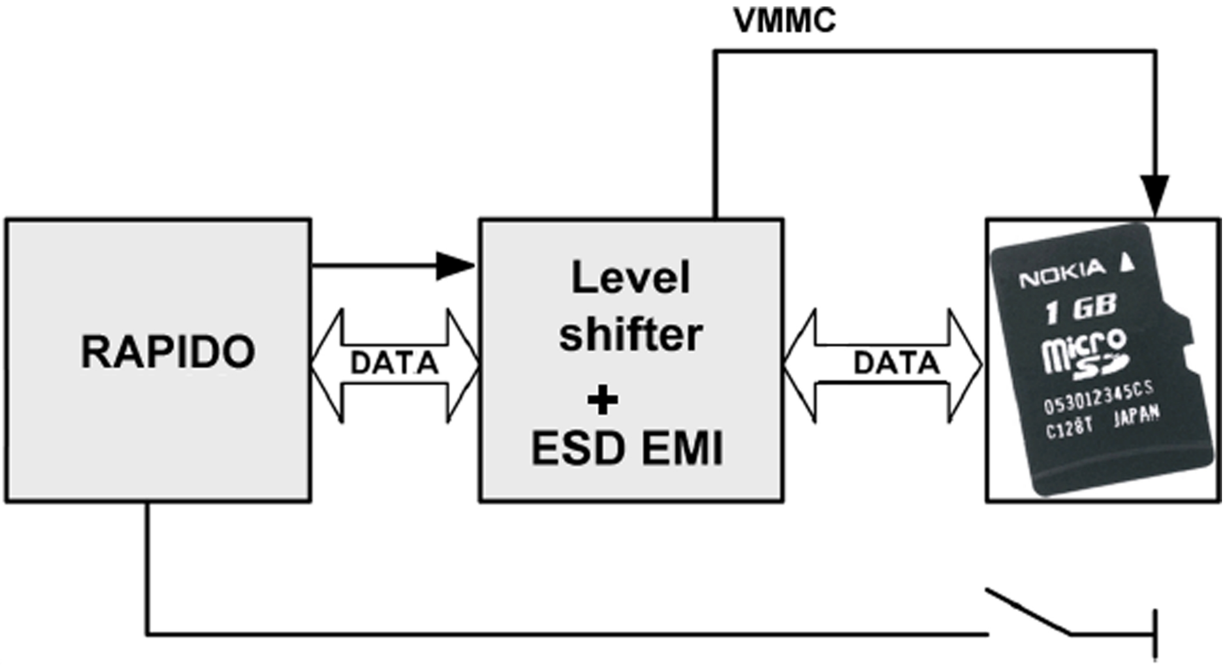

RAPIDO
SIMClk1
SIMIOCtrl1
SIMIODa1
EM ASIC
BSI
SIMClk1
SIMIOC1
SIMIODa1
SIMClkC1
SIMRstC1
SIMDaC1
VSIM1
From battery contact
C5
C6
C7
C8
C1
C2
C3
C4

Figure 41 SIM interface

The EM ASIC handles the detection of the SIM card. The detection method is based in the BSI line. Because of the location of the SIM card, removing the battery causes a quick power down of the SIM IF.

The EM ASIC SIM1 interface supports both 1.8 V and 3.0 V SIM cards. The SIM interface voltage is first 1.8 V when the SIM card is inserted, and if the card does not response to the ATR a 3 V interface voltage is used.

μSD card interface


VMMC
RAPIDO
DATA
Level shifter
+
ESD EMI
DATA
NOKIA
1 GB
micro SD
053012345CS
C128T JAPAN

The μSD card is connected to the engine by an external level shifter with an ESD protection filter. Supplied voltages:

- VMMC: 2.85 V (from level shifter)
- VIO: 1.8 V (from AVILMA)

The μSD card door state is detected by a detect switch. When the door is open, the μSD card is powered off. Hot swap is supported, which means that the card may be plugged in/out at any time, without removing the battery.

Camera concept

Cameras

RM-243 has two integrated digital cameras. The main camera is meant for high quality still imaging and video capture. The secondary (front) camera is meant for video conferencing but it can also be used for still image capture.

Main camera characteristics

Sensor type	CMOS
Sensor photo detectors	2.0 Million (1600 x 1200 pixels)
F number/Aperture	f/2.8
Focal length	4.4 mm
Focus range	40 cm to infinity
Still Image resolutions	1600x1200, 1152x864, 640x480
Still images file format	EXIF (JPEG), *.jpg
Video resolutions	320x240, 176x144 and 128x96
Video clip length	30 sec short mode or 1 hour free mode
Video file format	3GPP (*.3gp), MPEG-4 (*.mp4)
Exposure control	Automatic
White balance	Automatic, sunny, cloudy, incandescent, flurescent
Colour tones	Normal, sepia, vivid, black&white, negative
Capture Modes	Still capture mode, video mode and sequence mode
Selftimer	10, 20, 30 s
Flash settings	Auto, off and forced

Camera flash

The device has a camera flash module located directly beside the camera, providing better lighting conditions in darker environments.

The camera flash LED has four white LEDs connected in series in one module. The module also includes a lens with its plastic housing to ensure a proper light pattern at the target.

The dimensions of the camera flash module are 5.00 ± 0.1 mm x 5.00 ± 0.1 mm x 2.0 ± ? mm (general tolerance ± 0.15 mm).

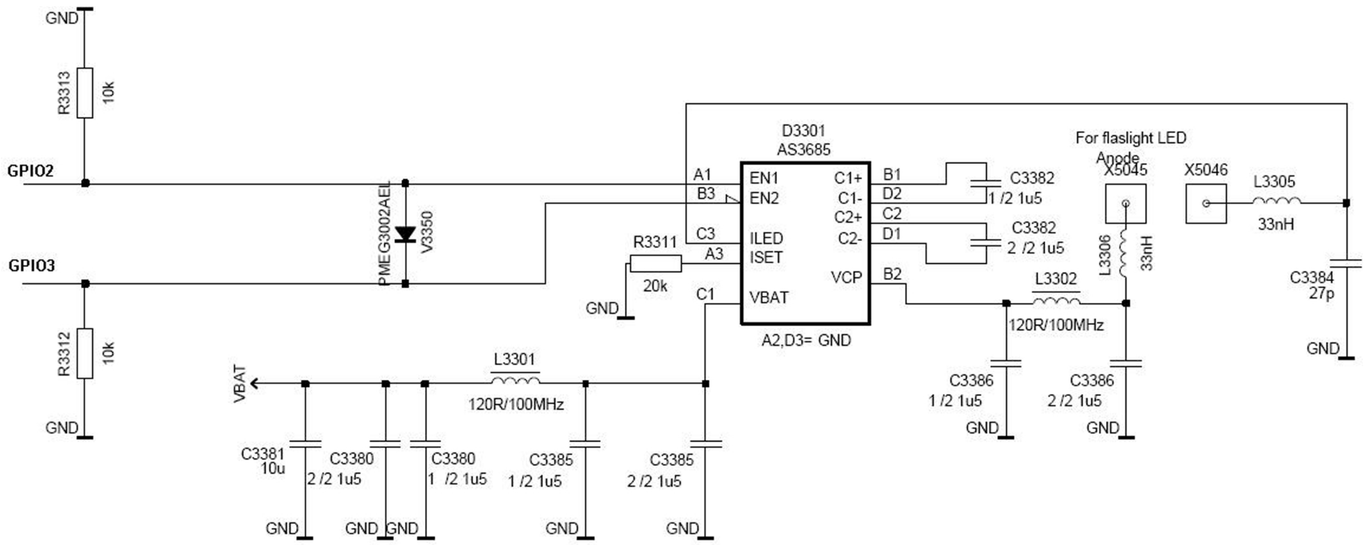

GND
R3313
10k
GPIO2
PMEG3002AEL
V3350
GPIO3
R3312
10k
GND
VBAT
C3381
10u
C3380
2 /2 1u5
C3380
1 /2 1u5
L3301
120R/100MHz
C3385
1 /2 1u5
C3385
2 /2 1u5
GND
GND
GND
GND
GND
R3311
20k
GND
D3301
AS3685
A1
B3
C3
A3
C1
EN1
EN2
ILED
ISET
VBAT
C1+
C1-
C2+
C2-
VCP
B1
D2
C2
D1
B2
A2,D3= GND
C3382
1 /2 1u5
C3382
2 /2 1u5
For flaslight LED
Anode
X5045
X5046
L3305
33nH
L3306
33nH
L3302
120R/100MHz
C3386
1 /2 1u5
C3386
2 /2 1u5
GND
GND
C3384
27p
GND

Figure 42 Camera flash and driver design

Secondary camera characteristics

Sensor type	CMOS
Sensor photo detectors (effective)	384x320
F number/Aperture	2.8
Focus range	25cm -> 1m
Still image resolutions	320x240
Still images format	EXIF (.jpg)
Video resolutions	176x144 or 128x96
Video clip length	30sec short mode or 1 hour free mode
Video file format	3GPP, (*.3gp)
Exposure control	Automatic
White Balance	Automatic
Colours	16.7 Million, 24bit

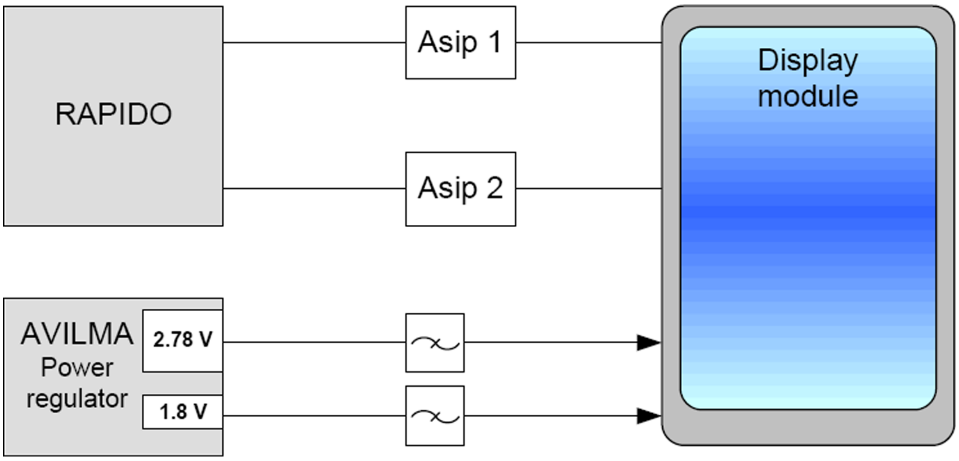
User interface

Display module

Display module

The display in RM-243 is an active TFT QVGA display that supports up to 16.777.216 colors (320x240 pixels).

The interconnection between the LCD module and the engine is implemented with a 24-pin board-to-board connector.


RAPIDO
Asip 1
Asip 2
Display module
AVILMA
Power regulator
2.78 V
1.8 V

Keyboard and other keys

The keyboard is placed on the top side of the engine PWB. All keys are connected to same keymatrix made by the RAPIDO genios.

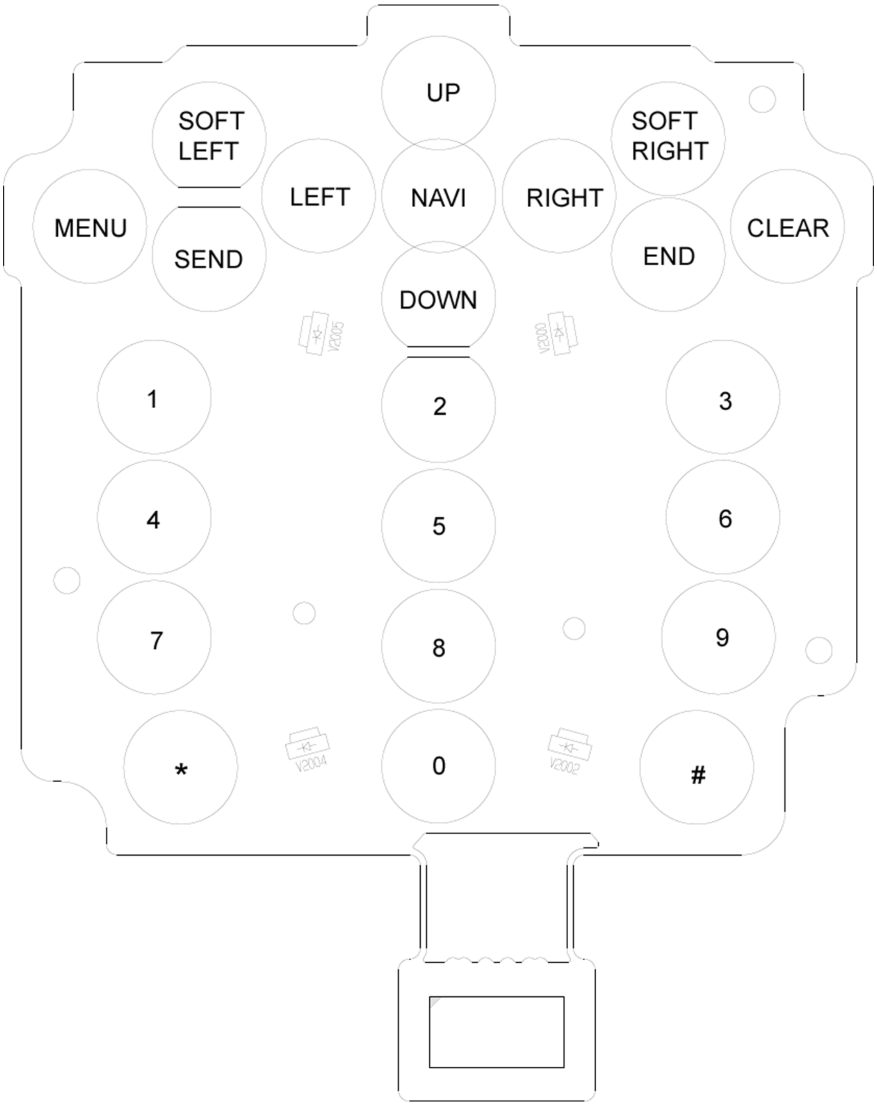

UP
SOFT LEFT
SOFT RIGHT
LEFT
NAVI
RIGHT
MENU
SEND
END
CLEAR
DOWN
V2005
V2000
1
2
3
4
5
6
7
8
9
*
V2004
0
V2002
#

Figure 43 Keyboard layout

Display and keypad backlight

There are two sets of LEDs illuminating the display and the keypads:

- Display LEDs, 4pcs
- Main keypad on PWB, 4 pcs, white colour

All sets share the same driver. None of the keypads can be illuminated without the LCD backlight being turned on.

ASICs

RAP ASIC

RAP ASIC is a 3G Radio Application Processor. RapidoYawe is the processor used in RM-243. Rapido is the processor unit, Yawe chip contains HSDPA logic, and it is stacked on the Rapido chip. Together they are called RapidoYawe.

EM ASIC N2300 (Betty)

The EM ASIC (N2300) includes the following functional blocks:

- Core supply generation
- Charge control circuitry
- Level shifter and regulator for USB/FBUS
- Current gauge for battery current measuring
- LED driver for backlights
- Digital interface (CBUS)

EM ASIC N2200 (Avilma)

The EM ASIC (N2200) includes the following functional blocks:

- Start up logic and reset control
- Charger detection
- Battery voltage monitoring
- 32.768kHz clock with external crystal
- Real time clock with external backup battery
- SIM card interface
- Stereo audio codecs and amplifiers
- A/D converter
- Regulators
- Vibra interface
- Digital interface (CBUS)

EMC ASIP (Appcation Specified Integrated Passive) have been integrated inside the ASIC. It includes biasing passives for microphone , EMC filter for SIM, microphones etc.

Device memories

RAP memories NOR flash and SDRAM

Modem memory consists of 128 Mbit SDRAM and 128 Mbit NOR flash memories.

Combo memory

The application memory of the device consists of NAND/DDR combo memory. The stacked DDR/NAND application memory has 512 Mbit of DDR memory and 1024 Mbit of flash memory.

Audio concept

Audio HW architecture

The functional core of the audio hardware is built around two ASICs: RAPIDO engine ASIC and the mixed signal ASIC Avilma.

Avilma provides an interface for the transducers and the accessory connector. Integrated handsfree speaker is driven by Avilma.

There are three audio transducers:

- 7x11 mm dynamic earpiece
- 11x15 mm dynamic speaker
- Analogue microphone

In addition to the audio transducers, Avilma also provides an output for the dynamic vibra component.

All galvanic audio accessories are connected to the AV accessory connector.

A Bluetooth audio and FM radio module, which is connected to the RAPIDO ASIC supports Bluetooth audio and FM radio functionality.

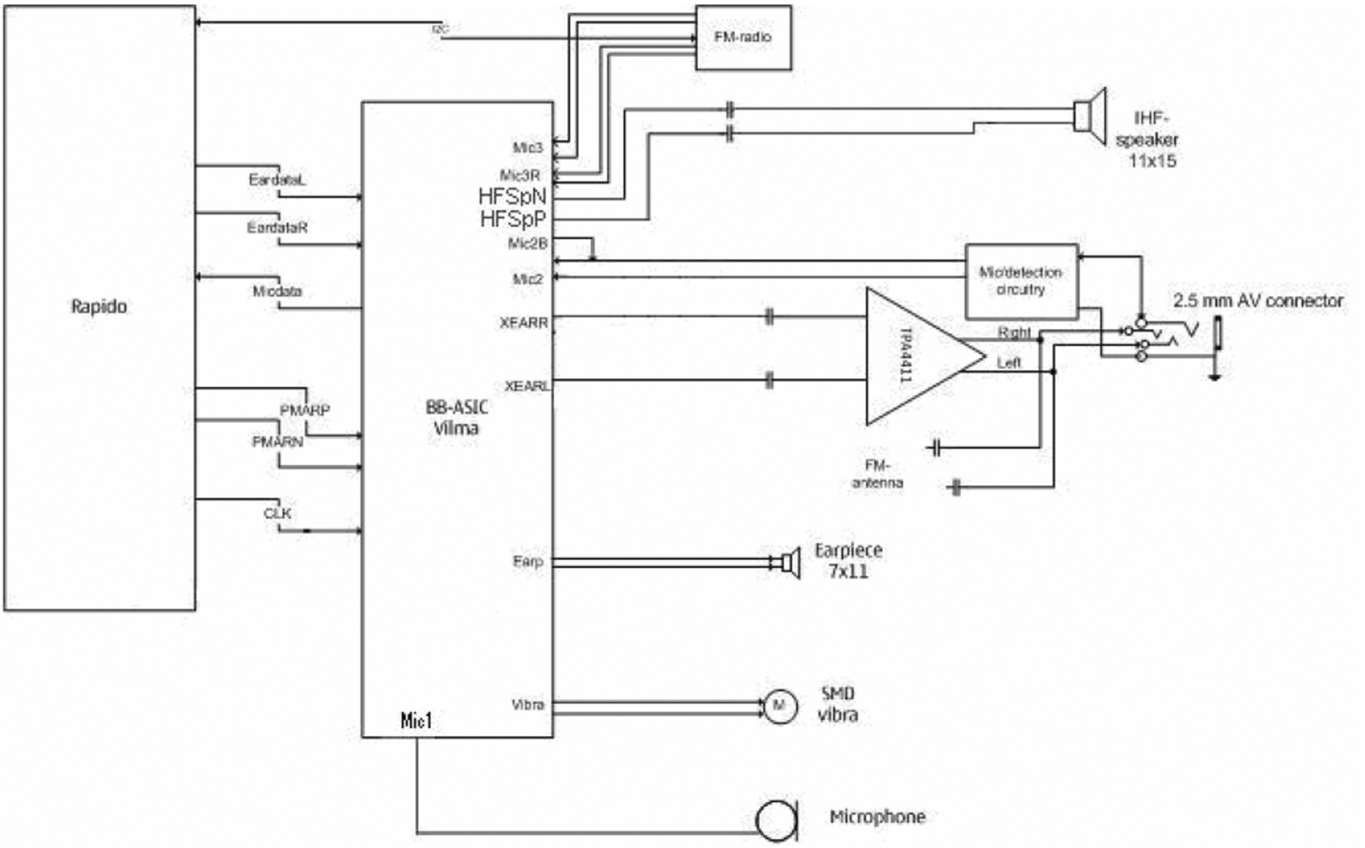

Rapido
I2C
FM-radio
EardataL
EardataR
Micdata
PMARP
PMARN
CLK
Mic3
Mic3R
HFSpN
HFSpP
Mic2B
Mic2
XEARR
XEARL
BB-ASIC
Vilma
Earp
Vibra
Mic1
IHF-
speaker
11x15
Mic/detection
circuitry
2.5 mm AV connector
TPA4411
Right
Left
FM-
antenna
Earpiece
7x11
M
SMD
vibra
Microphone

Figure 44 Audio block diagram

Internal microphone

Internal microphone is used for HandPortable (HP) and Internal HandsFree (IHF) call modes.

An analogue electret microphone is connected to N2200 Mic1P and Mic1N inputs via asymmetric electrical connection.

The microphone is biased by ASIC N2200.

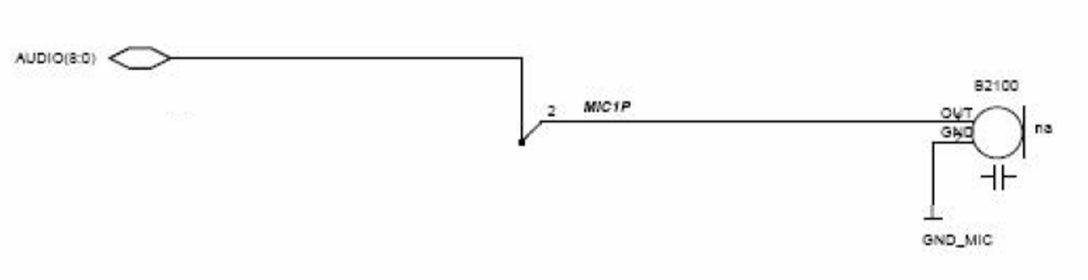

AUDIO(8:0)
2
MIC1P
B2100
OUT
GND
na
GND_MIC

Figure 45 Internal microphone circuitry

External microphone

Galvanic accessories are connected to the AV connector.

Accessory audio mode is automatically enabled/disabled during connection/disconnection of dedicated phone accessories.

External microphone circuitry is biased by Avilma ASIC MicB2 bias voltage output. The circuitry provides an asymmetrical connection for the microphone from the AV connector, XMICP to Avilma ASIC input, mic2p and XMICN, to GND.

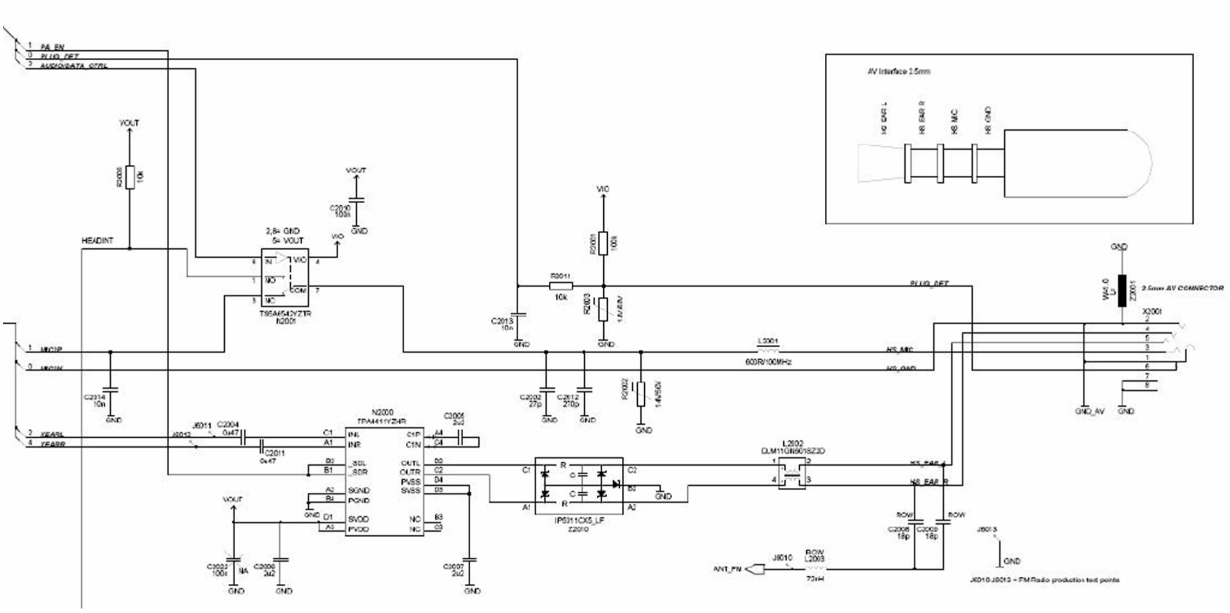

PA_EN
PLUG_DET
AUDIO/DATA_CTRL
VOUT
R2008
10k
HEADINT
2,8= GND
5= VOUT
IN
NO
NC
VIO
COM
TS5A6542YZTR
N2001
VOUT
C2010
100n
GND
VIO
R2001
100k
R2011
10k
R2003
C2013
10n
GND
MICIP
MICIN
C2014
10n
GND
C2002
27p
C2012
270p
R2002
14V/50V
L2001
600R/100MHz
HS_MIC
HS_GND
PLUG_DET
XEARL
XEARR
J6011
J6012
C2004
0u47
C2011
0u47
N2000
TPA4411YZHR
INL
INR
_SDL
_SDR
SGND
PGND
SVDD
PVDD
C1P
C1N
OUTL
OUTR
PVSS
SVSS
NC
C2005
2u2
VOUT
C2022
100n
NA
C2006
2u2
C2007
2u2
GND
IP5311CX5_LF
Z2010
L2002
DLM11GN601SZ3D
HS_EAR_L
HS_EAR_R
ROW
C2008
18p
C2009
18p
J6013
GND
ANT_FM
J6010
L2003
72nH
J6010-J6013 = FM Radio production test points
AV Interface 2.5mm
HS EAR L
HS EAR R
HS MIC
HS GND
GND
Z2001
2.5mm AV CONNECTOR
X2001
GND_AV

Figure 46 External earpiece and microphone circuitry (AV connected on the right)

Internal earpiece

Internal earpiece is used for the HandPortable (HP) call mode. A dynamic 7x11 mm earpiece capsule is connected to Avilma ASIC’s differential output EarP and EarN.

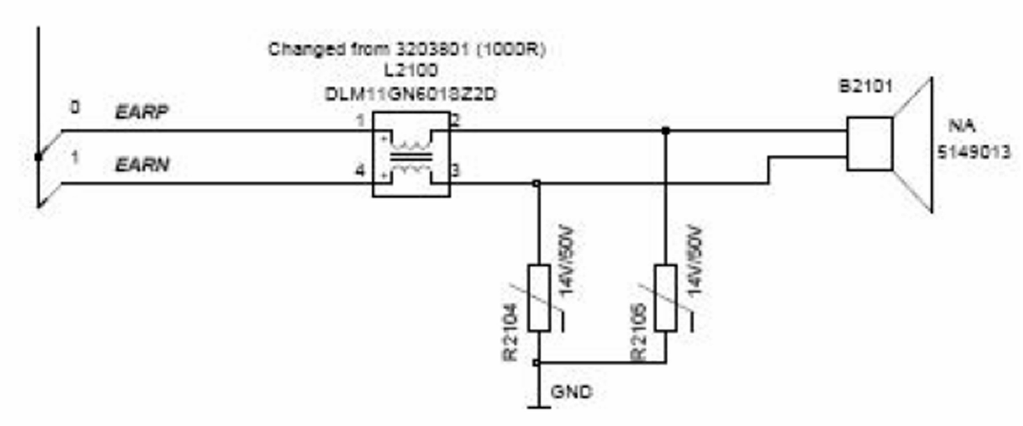

Changed from 3203801 (1000R)
L2100
DLM11GN601SZ2D
0
EARP
1
EARN
1
2
4
3
B2101
NA
5149013
R2104
14V/50V
R2105
14V/50V
GND

Figure 47 Internal earpiece circuitry

Internal speaker

Internal speaker is used for Internal HandsFree (IHF) call mode, video call, ringing tones, FM radio and music listening.

One dynamic 11x15mm speakers is connected to Avilma ASIC’s outputs HFSPP/HFSPN.

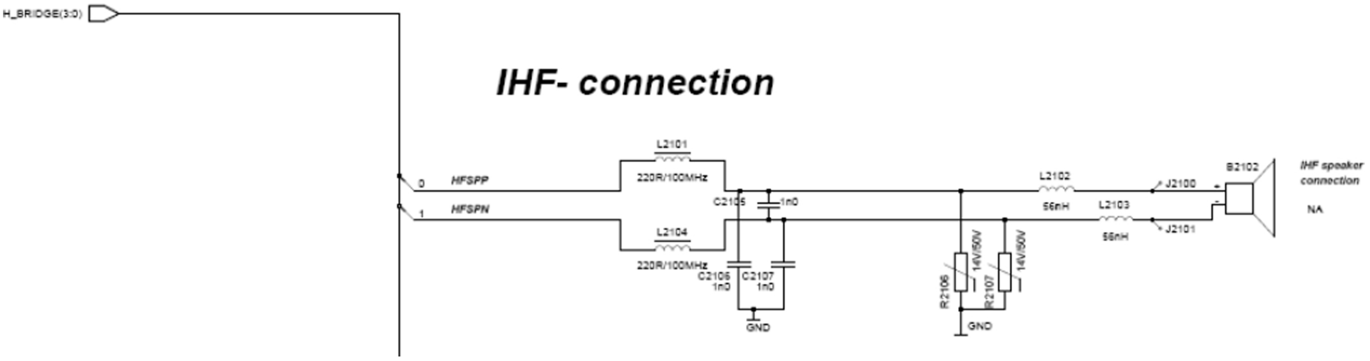

H_BRIDGE(3:0)
IHF- connection
L2101
220R/100MHz
0
HFSPP
1
HFSPN
L2104
220R/100MHz
C2105
1n0
C2106
1n0
C2107
1n0
GND
R2106
14V/50V
R2107
14V/50V
GND
L2102
56nH
L2103
56nH
J2100
J2101
B2102
IHF speaker connection
NA

Figure 48 Internal speaker circuitry

External earpiece

Galvanic accessories are connected to the AV connector.

Accessory audio mode is automatically enabled/disabled during connection/disconnection of dedicated phone accessories.

The Avilma ASIC provides two output channels in either single-ended or differential format. The Avilma ASIC outputs XearL and XearLC form the left channel audio output, and XearR and XearRC from the right channel audio output. XearLC and XearRC are the ground pins if the output works in a single-ended operation.

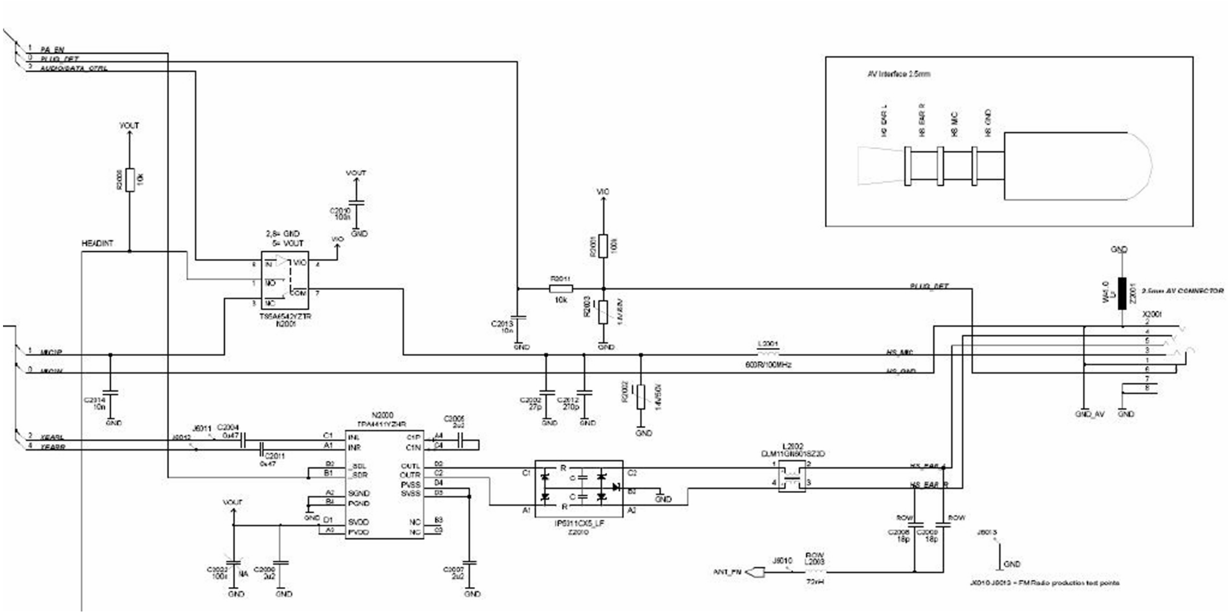


Figure 49 External earpiece and microphone circuitry (AV connected on the right)

Vibra circuitry

Vibra is used for the vibra alarm function.

The vibra motor is connected to the Avilma ASIC VibraP and VibraN Pulse Width Modulated (PWM) outputs.

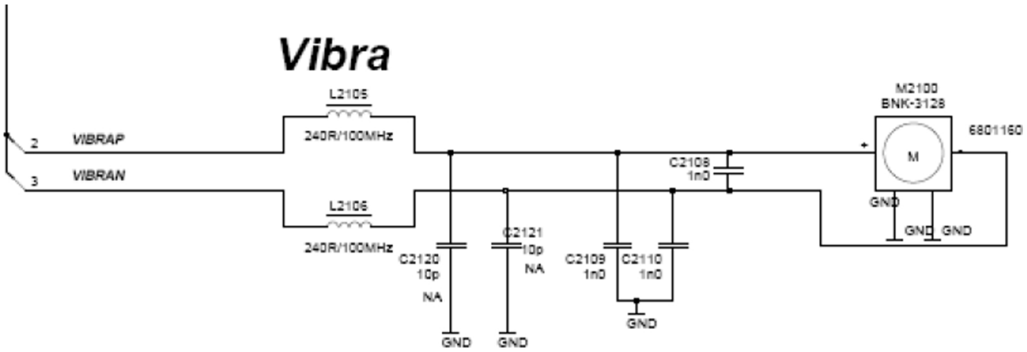

Vibra
L2105
240R/100MHz
2
VIBRAP
3
VIBRAN
L2106
240R/100MHz
C2120
10p
NA
C2121
10p
NA
C2109
1n0
C2110
1n0
C2108
1n0
M2100
BNK-3128
M
6801160
GND

Figure 50 Vibra circuitry

AV connector

The AV connector consists of single ended mono or stereo audio output and mono audio input.

The handsfree driver in Avilma is meant for the headset.

Table 15 AV interface electrical characteristics

Signal name	Function/ Parameter	Min	Typ	Max	Unit	Notes
HSMIC	HS mic audio input	-	-	1.3 V_{pp}	V	Max. negative level - 0.7 V
HSEARL	HS EAR L audio output	-	-	2 V_{pp}	V	SPR requirement
HSEARR	HS EAR R audio output	-	-	2 V_{pp}	V	SPR requirement

Signal name	Function/ Parameter	Min	Typ	Max	Unit	Notes
MICBIAS	HS MIC bias voltage	2.05	2.1	2.25	V	
ECI	Vin high	1.7	-	2.6	V	
ECI	Vin low	0	-	0.7	V	

Baseband technical specifications

External interfaces

Name of Connection	Connector reference
USB	X2005 (on engine PWB)
Charger	X2000 (on engine PWB)
Headset	X2001
SIM	X2007
Micro SD	X3200
Battery connector	X2070 (on engine PWB)

SIM IF connections

Pin	Signal	I/O	Engine connection		Notes
C1	VSIM	Out	EM ASIC N2200	VSIM1	Supply voltage to SIM card, 1.8V or 3.0V.
C2	SIMRST	Out	EM ASIC N2200	SIM1Rst	Reset signal to SIM card
C3	SIMCLK	Out	EM ASIC N2200	SIM1ClkC	Clock signal to SIM card
C5	GND	-	GND		Ground
C7	SIMDATA	In/Out	EM ASIC N2200	SIM1DaC	Data input / output
SW	SIM_DET	In	EM ASIC N2200	SIMDetX	Removal detection

Charging interface connections & electrical characteristics

Table 16 Charging interface connections

Pin	Signal	I/O	Engine connection		Notes
1	Vchar	In	N2300	VCharIn1, 2	Charging voltage / charger detection, Center pin
2	Charge GND		Ground		Charger ground

Table 17 Charging IF electrical characteristics

Description	Parameter	Min	Max	Unit	Notes
Vchar	V Charge	0	9	V	Center pin
Vchar	I Charge		0.85	A	Center pin
Charge GND			0.85	A	

Internal interfaces

Name of Connection	Connector reference
Earpiece	B2101
Display connector	X2400
Keypad connector	X2401
IHF speaker	B2102
Main camera connector	X3300
Microphone	B2100
2nd camera	N3301
Vibra	M2100

Back-up battery interface electrical characteristics

Table 18 Back-up battery connections

Pin name	I/O	Connection	Notes
L2207, VBack	->	N2200, VBack	Back-up battery G2200 is connected to N2200

Table 19 Back-up battery electrical characteristics

Description	Parameter	Min	Typ	Max	Unit
Back-Up Battery Voltage	Vback	0	2.6	3.3	V

RF description

Block diagram

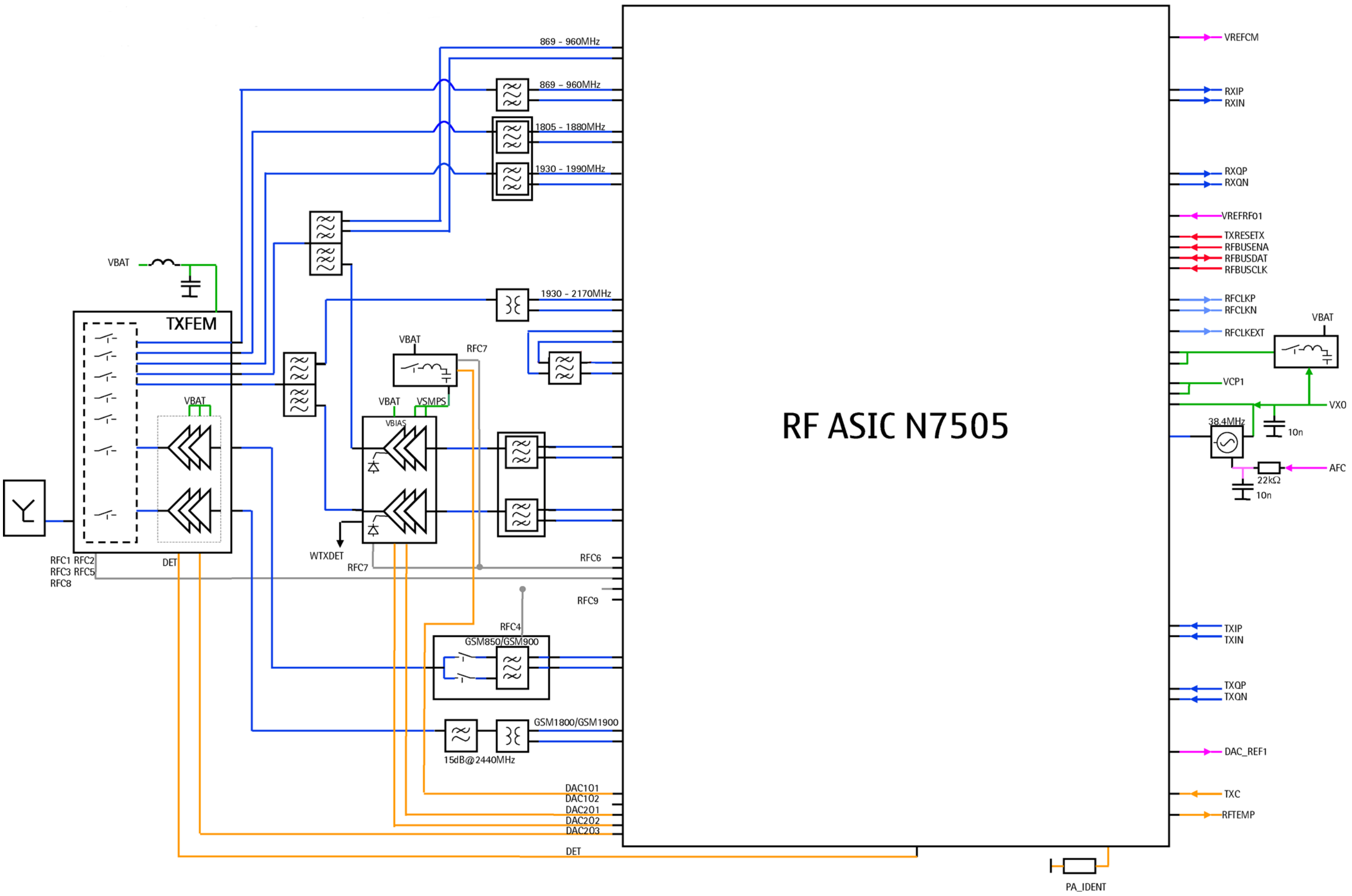

869 - 960MHz
869 - 960MHz
1805 - 1880MHz
1930 - 1990MHz
1930 - 2170MHz
VBAT
TXFEM
VBAT
VBAT
RFC7
VBAT
VSMPS
VBIAS
WTXDET
RFC7
RFC6
RFC9
RFC4
GSM850/GSM900
GSM1800/GSM1900
15dB@2440MHz
DAC101
DAC102
DAC201
DAC202
DAC203
DET
DET
RFC1 RFC2
RFC3 RFC5
RFC8
RF ASIC N7505
VREFCM
RXIP
RXIN
RXQP
RXQN
VREFRF01
TXRESETX
RFBUSENA
RFBUSDAT
RFBUSCLK
RFCLKP
RFCLKN
RFCLKEXT
VBAT
VCP1
VXO
38.4MHz
10n
AFC
22kΩ
10n
TXIP
TXIN
TXQP
TXQN
DAC_REF1
TXC
RFTEMP
PA_IDENT

Figure 51 RF block diagram using RF ASIC N7505

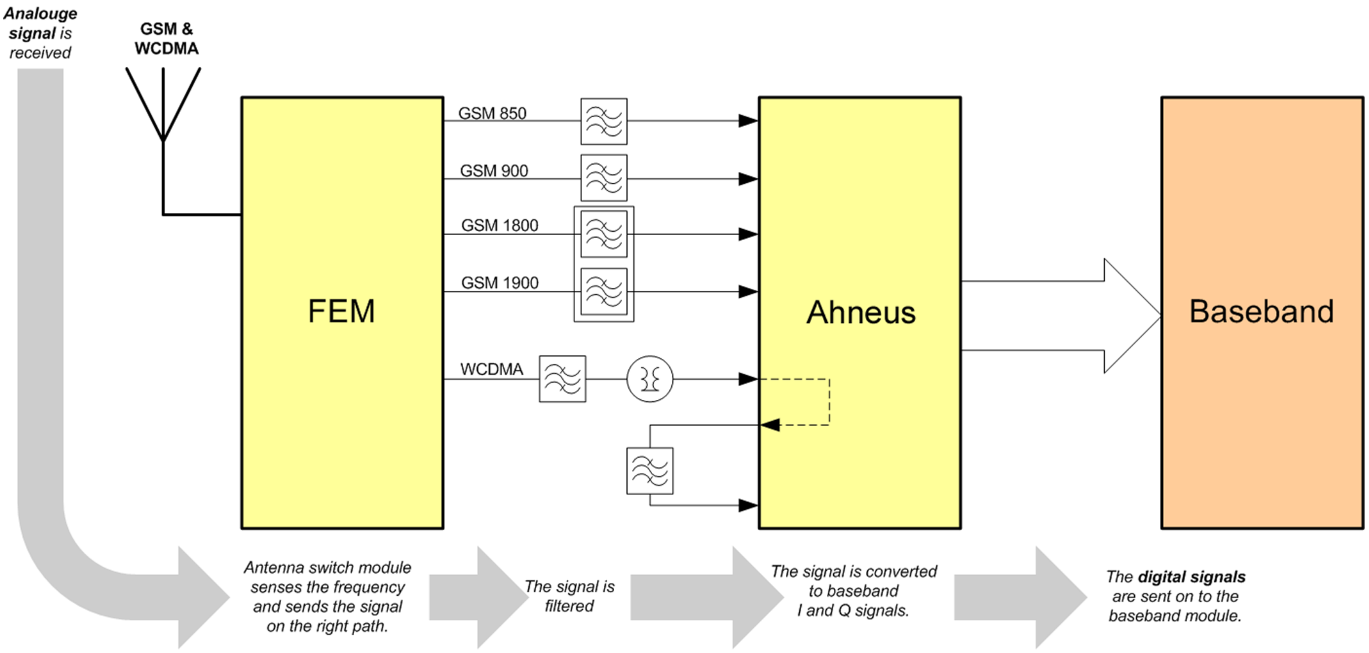
The RF block diagram uses RF ASIC N7505 that performs the RF back-end functions of receive and transmit function of the cellular transceiver.

Receiver (RX)

An analogue signal is received by the phone's antenna. The signal is converted to a digital signal and is then transferred further to the baseband (eg. to the earpiece).

The receiver functions are implemented in the RF ASIC.

Signals with different frequencies take different "ways", being handled by different components. The principle of GSM and WCDMA is the same.

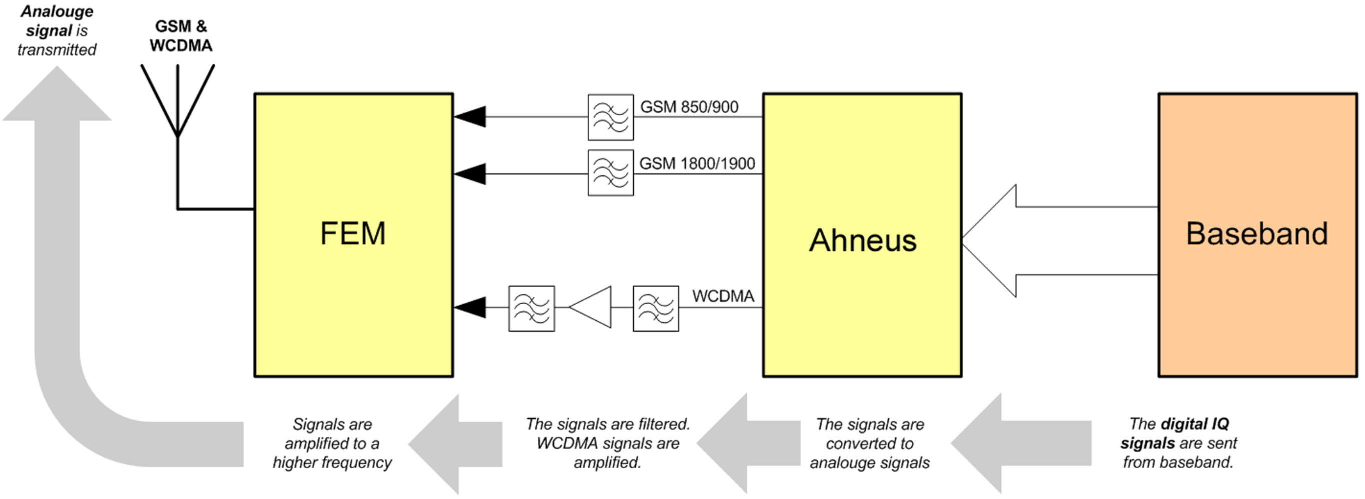

Analouge **signal** is received
GSM & WCDMA
FEM
GSM 850
GSM 900
GSM 1800
GSM 1900
WCDMA
Ahneus
Baseband
Antenna switch module senses the frequency and sends the signal on the right path.
The signal is filtered
The signal is converted to baseband I and Q signals.
The **digital signals** are sent on to the baseband module.

Transmitter (TX)

The digital baseband signal (eg. from the microphone) is converted to an analogue signal, which is then amplified and transmitted from the antenna. The frequency of this signal can be tuned to match the bandwidth of the system in use (eg. GSM900).

The transmitter functions are implemented in the RF ASIC.

Even though the GSM and WCDMA signals pass different components, the principles of the transmission is the same.


Analouge **signal** is transmitted
GSM & WCDMA
FEM
GSM 850/900
GSM 1800/1900
WCDMA
Ahneus
Baseband
Signals are amplified to a higher frequency
The signals are filtered. WCDMA signals are amplified.
The signals are converted to analouge signals
The **digital IQ signals** are sent from baseband.

Frequency mappings

GSM850 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
128	824.2	869.2	3296.8	3476.8	170	832.6	877.6	3330.4	3510.4	212	841.0	886.0	3364.0	3544.0
129	824.4	869.4	3297.6	3477.6	171	832.8	877.8	3331.2	3511.2	213	841.2	886.2	3364.8	3544.8
130	824.6	869.6	3298.4	3478.4	172	833.0	878.0	3332.0	3512.0	214	841.4	886.4	3365.6	3545.6
131	824.8	869.8	3299.2	3479.2	173	833.2	878.2	3332.8	3512.8	215	841.6	886.6	3366.4	3546.4
132	825.0	870.0	3300.0	3480.0	174	833.4	878.4	3333.6	3513.6	216	841.8	886.8	3367.2	3547.2
133	825.2	870.2	3300.8	3480.8	175	833.6	878.6	3334.4	3514.4	217	842.0	887.0	3368.0	3548.0
134	825.4	870.4	3301.6	3481.6	176	833.8	878.8	3335.2	3515.2	218	842.2	887.2	3368.8	3548.8
135	825.6	870.6	3302.4	3482.4	177	834.0	879.0	3336.0	3516.0	219	842.4	887.4	3369.6	3549.6
136	825.8	870.8	3303.2	3483.2	178	834.2	879.2	3336.8	3516.8	220	842.6	887.6	3370.4	3550.4
137	826.0	871.0	3304.0	3484.0	179	834.4	879.4	3337.6	3517.6	221	842.8	887.8	3371.2	3551.2
138	826.2	871.2	3304.8	3484.8	180	834.6	879.6	3338.4	3518.4	222	843.0	888.0	3372.0	3552.0
139	826.4	871.4	3305.6	3485.6	181	834.8	879.8	3339.2	3519.2	223	843.2	888.2	3372.8	3552.8
140	826.6	871.6	3306.4	3486.4	182	835.0	880.0	3340.0	3520.0	224	843.4	888.4	3373.6	3553.6
141	826.8	871.8	3307.2	3487.2	183	835.2	880.2	3340.8	3520.8	225	843.6	888.6	3374.4	3554.4
142	827.0	872.0	3308.0	3488.0	184	835.4	880.4	3341.6	3521.6	226	843.8	888.8	3375.2	3555.2
143	827.2	872.2	3308.8	3488.8	185	835.6	880.6	3342.4	3522.4	227	844.0	889.0	3376.0	3556.0
144	827.4	872.4	3309.6	3489.6	186	835.8	880.8	3343.2	3523.2	228	844.2	889.2	3376.8	3556.8
145	827.6	872.6	3310.4	3490.4	187	836.0	881.0	3344.0	3524.0	229	844.4	889.4	3377.6	3557.6
146	827.8	872.8	3311.2	3491.2	188	836.2	881.2	3344.8	3524.8	230	844.6	889.6	3378.4	3558.4
147	828.0	873.0	3312.0	3492.0	189	836.4	881.4	3345.6	3525.6	231	844.8	889.8	3379.2	3559.2
148	828.2	873.2	3312.8	3492.8	190	836.6	881.6	3346.4	3526.4	232	845.0	890.0	3380.0	3560.0
149	828.4	873.4	3313.6	3493.6	191	836.8	881.8	3347.2	3527.2	233	845.2	890.2	3380.8	3560.8
150	828.6	873.6	3314.4	3494.4	192	837.0	882.0	3348.0	3528.0	234	845.4	890.4	3381.6	3561.6
151	828.8	873.8	3315.2	3495.2	193	837.2	882.2	3348.8	3528.8	235	845.6	890.6	3382.4	3562.4
152	829.0	874.0	3316.0	3496.0	194	837.4	882.4	3349.6	3529.6	236	845.8	890.8	3383.2	3563.2
153	829.2	874.2	3316.8	3496.8	195	837.6	882.6	3350.4	3530.4	237	846.0	891.0	3384.0	3564.0
154	829.4	874.4	3317.6	3497.6	196	837.8	882.8	3351.2	3531.2	238	846.2	891.2	3384.8	3564.8
155	829.6	874.6	3318.4	3498.4	197	838.0	883.0	3352.0	3532.0	239	846.4	891.4	3385.6	3565.6
156	829.8	874.8	3319.2	3499.2	198	838.2	883.2	3352.8	3532.8	240	846.6	891.6	3386.4	3566.4
157	830.0	875.0	3320.0	3500.0	199	838.4	883.4	3353.6	3533.6	241	846.8	891.8	3387.2	3567.2
158	830.2	875.2	3320.8	3500.8	200	838.6	883.6	3354.4	3534.4	242	847.0	892.0	3388.0	3568.0
159	830.4	875.4	3321.6	3501.6	201	838.8	883.8	3355.2	3535.2	243	847.2	892.2	3388.8	3568.8
160	830.6	875.6	3322.4	3502.4	202	839.0	884.0	3356.0	3536.0	244	847.4	892.4	3389.6	3569.6
161	830.8	875.8	3323.2	3503.2	203	839.2	884.2	3356.8	3536.8	245	847.6	892.6	3390.4	3570.4
162	831.0	876.0	3324.0	3504.0	204	839.4	884.4	3357.6	3537.6	246	847.8	892.8	3391.2	3571.2
163	831.2	876.2	3324.8	3504.8	205	839.6	884.6	3358.4	3538.4	247	848.0	893.0	3392.0	3572.0
164	831.4	876.4	3325.6	3505.6	206	839.8	884.8	3359.2	3539.2	248	848.2	893.2	3392.8	3572.8
165	831.6	876.6	3326.4	3506.4	207	840.0	885.0	3360.0	3540.0	249	848.4	893.4	3393.6	3573.6
166	831.8	876.8	3327.2	3507.2	208	840.2	885.2	3360.8	3540.8	250	848.6	893.6	3394.4	3574.4
167	832.0	877.0	3328.0	3508.0	209	840.4	885.4	3361.6	3541.6	251	848.8	893.8	3395.2	3575.2

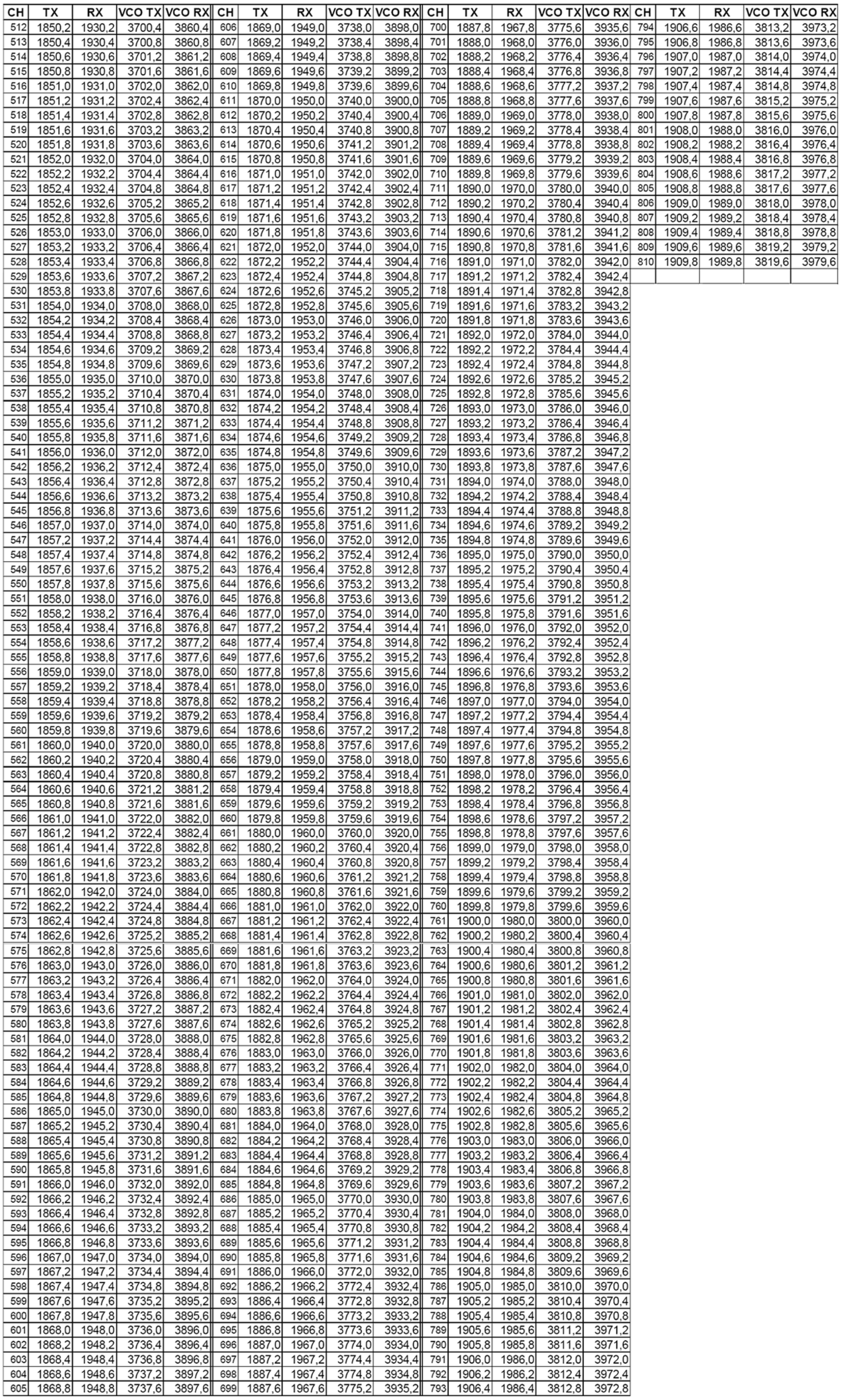
EGSM900 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
975	880,2	925,2	3520,8	3700,8	1	890,2	935,2	3560,8	3740,8	63	902,6	947,6	3610,4	3790,4
976	880,4	925,4	3521,6	3701,6	2	890,4	935,4	3561,6	3741,6	64	902,8	947,8	3611,2	3791,2
977	880,6	925,6	3522,4	3702,4	3	890,6	935,6	3562,4	3742,4	65	903,0	948,0	3612,0	3792,0
978	880,8	925,8	3523,2	3703,2	4	890,8	935,8	3563,2	3743,2	66	903,2	948,2	3612,8	3792,8
979	881,0	926,0	3524,0	3704,0	5	891,0	936,0	3564,0	3744,0	67	903,4	948,4	3613,6	3793,6
980	881,2	926,2	3524,8	3704,8	6	891,2	936,2	3564,8	3744,8	68	903,6	948,6	3614,4	3794,4
981	881,4	926,4	3525,6	3705,6	7	891,4	936,4	3565,6	3745,6	69	903,8	948,8	3615,2	3795,2
982	881,6	926,6	3526,4	3706,4	8	891,6	936,6	3566,4	3746,4	70	904,0	949,0	3616,0	3796,0
983	881,8	926,8	3527,2	3707,2	9	891,8	936,8	3567,2	3747,2	71	904,2	949,2	3616,8	3796,8
984	882,0	927,0	3528,0	3708,0	10	892,0	937,0	3568,0	3748,0	72	904,4	949,4	3617,6	3797,6
985	882,2	927,2	3528,8	3708,8	11	892,2	937,2	3568,8	3748,8	73	904,6	949,6	3618,4	3798,4
986	882,4	927,4	3529,6	3709,6	12	892,4	937,4	3569,6	3749,6	74	904,8	949,8	3619,2	3799,2
987	882,6	927,6	3530,4	3710,4	13	892,6	937,6	3570,4	3750,4	75	905,0	950,0	3620,0	3800,0
988	882,8	927,8	3531,2	3711,2	14	892,8	937,8	3571,2	3751,2	76	905,2	950,2	3620,8	3800,8
989	883,0	928,0	3532,0	3712,0	15	893,0	938,0	3572,0	3752,0	77	905,4	950,4	3621,6	3801,6
990	883,2	928,2	3532,8	3712,8	16	893,2	938,2	3572,8	3752,8	78	905,6	950,6	3622,4	3802,4
991	883,4	928,4	3533,6	3713,6	17	893,4	938,4	3573,6	3753,6	79	905,8	950,8	3623,2	3803,2
992	883,6	928,6	3534,4	3714,4	18	893,6	938,6	3574,4	3754,4	80	906,0	951,0	3624,0	3804,0
993	883,8	928,8	3535,2	3715,2	19	893,8	938,8	3575,2	3755,2	81	906,2	951,2	3624,8	3804,8
994	884,0	929,0	3536,0	3716,0	20	894,0	939,0	3576,0	3756,0	82	906,4	951,4	3625,6	3805,6
995	884,2	929,2	3536,8	3716,8	21	894,2	939,2	3576,8	3756,8	83	906,6	951,6	3626,4	3806,4
996	884,4	929,4	3537,6	3717,6	22	894,4	939,4	3577,6	3757,6	84	906,8	951,8	3627,2	3807,2
997	884,6	929,6	3538,4	3718,4	23	894,6	939,6	3578,4	3758,4	85	907,0	952,0	3628,0	3808,0
998	884,8	929,8	3539,2	3719,2	24	894,8	939,8	3579,2	3759,2	86	907,2	952,2	3628,8	3808,8
999	885,0	930,0	3540,0	3720,0	25	895,0	940,0	3580,0	3760,0	87	907,4	952,4	3629,6	3809,6
1000	885,2	930,2	3540,8	3720,8	26	895,2	940,2	3580,8	3760,8	88	907,6	952,6	3630,4	3810,4
1001	885,4	930,4	3541,6	3721,6	27	895,4	940,4	3581,6	3761,6	89	907,8	952,8	3631,2	3811,2
1002	885,6	930,6	3542,4	3722,4	28	895,6	940,6	3582,4	3762,4	90	908,0	953,0	3632,0	3812,0
1003	885,8	930,8	3543,2	3723,2	29	895,8	940,8	3583,2	3763,2	91	908,2	953,2	3632,8	3812,8
1004	886,0	931,0	3544,0	3724,0	30	896,0	941,0	3584,0	3764,0	92	908,4	953,4	3633,6	3813,6
1005	886,2	931,2	3544,8	3724,8	31	896,2	941,2	3584,8	3764,8	93	908,6	953,6	3634,4	3814,4
1006	886,4	931,4	3545,6	3725,6	32	896,4	941,4	3585,6	3765,6	94	908,8	953,8	3635,2	3815,2
1007	886,6	931,6	3546,4	3726,4	33	896,6	941,6	3586,4	3766,4	95	909,0	954,0	3636,0	3816,0
1008	886,8	931,8	3547,2	3727,2	34	896,8	941,8	3587,2	3767,2	96	909,2	954,2	3636,8	3816,8
1009	887,0	932,0	3548,0	3728,0	35	897,0	942,0	3588,0	3768,0	97	909,4	954,4	3637,6	3817,6
1010	887,2	932,2	3548,8	3728,8	36	897,2	942,2	3588,8	3768,8	98	909,6	954,6	3638,4	3818,4
1011	887,4	932,4	3549,6	3729,6	37	897,4	942,4	3589,6	3769,6	99	909,8	954,8	3639,2	3819,2
1012	887,6	932,6	3550,4	3730,4	38	897,6	942,6	3590,4	3770,4	100	910,0	955,0	3640,0	3820,0
1013	887,8	932,8	3551,2	3731,2	39	897,8	942,8	3591,2	3771,2	101	910,2	955,2	3640,8	3820,8
1014	888,0	933,0	3552,0	3732,0	40	898,0	943,0	3592,0	3772,0	102	910,4	955,4	3641,6	3821,6
1015	888,2	933,2	3552,8	3732,8	41	898,2	943,2	3592,8	3772,8	103	910,6	955,6	3642,4	3822,4
1016	888,4	933,4	3553,6	3733,6	42	898,4	943,4	3593,6	3773,6	104	910,8	955,8	3643,2	3823,2
1017	888,6	933,6	3554,4	3734,4	43	898,6	943,6	3594,4	3774,4	105	911,0	956,0	3644,0	3824,0
1018	888,8	933,8	3555,2	3735,2	44	898,8	943,8	3595,2	3775,2	106	911,2	956,2	3644,8	3824,8
1019	889,0	934,0	3556,0	3736,0	45	899,0	944,0	3596,0	3776,0	107	911,4	956,4	3645,6	3825,6
1020	889,2	934,2	3556,8	3736,8	46	899,2	944,2	3596,8	3776,8	108	911,6	956,6	3646,4	3826,4
1021	889,4	934,4	3557,6	3737,6	47	899,4	944,4	3597,6	3777,6	109	911,8	956,8	3647,2	3827,2
1022	889,6	934,6	3558,4	3738,4	48	899,6	944,6	3598,4	3778,4	110	912,0	957,0	3648,0	3828,0
1023	889,8	934,8	3559,2	3739,2	49	899,8	944,8	3599,2	3779,2	111	912,2	957,2	3648,8	3828,8
0	890,0	935,0	3560,0	3740,0	50	900,0	945,0	3600,0	3780,0	112	912,4	957,4	3649,6	3829,6
					51	900,2	945,2	3600,8	3780,8	113	912,6	957,6	3650,4	3830,4
					52	900,4	945,4	3601,6	3781,6	114	912,8	957,8	3651,2	3831,2
					53	900,6	945,6	3602,4	3782,4	115	913,0	958,0	3652,0	3832,0
					54	900,8	945,8	3603,2	3783,2	116	913,2	958,2	3652,8	3832,8
					55	901,0	946,0	3604,0	3784,0	117	913,4	958,4	3653,6	3833,6
					56	901,2	946,2	3604,8	3784,8	118	913,6	958,6	3654,4	3834,4
					57	901,4	946,4	3605,6	3785,6	119	913,8	958,8	3655,2	3835,2
					58	901,6	946,6	3606,4	3786,4	120	914,0	959,0	3656,0	3836,0
					59	901,8	946,8	3607,2	3787,2	121	914,2	959,2	3656,8	3836,8
					60	902,0	947,0	3608,0	3788,0	122	914,4	959,4	3657,6	3837,6
					61	902,2	947,2	3608,8	3788,8	123	914,6	959,6	3658,4	3838,4
					62	902,4	947,4	3609,6	3789,6	124	914,8	959,8	3659,2	3839,2

GSM1800 frequencies

Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx
512	1710.2	1805.2	3420.4	3610.4	606	1729.0	1824.0	3458.0	3648.0	700	1747.8	1842.8	3495.6	3685.6	793	1766.4	1861.4	3532.8	3722.8
513	1710.4	1805.4	3420.8	3610.8	607	1729.2	1824.2	3458.4	3648.4	701	1748.0	1843.0	3496.0	3686.0	794	1766.6	1861.6	3533.2	3723.2
514	1710.6	1805.6	3421.2	3611.2	608	1729.4	1824.4	3458.8	3648.8	702	1748.2	1843.2	3496.4	3686.4	795	1766.8	1861.8	3533.6	3723.6
515	1710.8	1805.8	3421.6	3611.6	609	1729.6	1824.6	3459.2	3649.2	703	1748.4	1843.4	3496.8	3686.8	796	1767.0	1862.0	3534.0	3724.0
516	1711.0	1806.0	3422.0	3612.0	610	1729.8	1824.8	3459.6	3649.6	704	1748.6	1843.6	3497.2	3687.2	797	1767.2	1862.2	3534.4	3724.4
517	1711.2	1806.2	3422.4	3612.4	611	1730.0	1825.0	3460.0	3650.0	705	1748.8	1843.8	3497.6	3687.6	798	1767.4	1862.4	3534.8	3724.8
518	1711.4	1806.4	3422.8	3612.8	612	1730.2	1825.2	3460.4	3650.4	706	1749.0	1844.0	3498.0	3688.0	799	1767.6	1862.6	3535.2	3725.2
519	1711.6	1806.6	3423.2	3613.2	613	1730.4	1825.4	3460.8	3650.8	707	1749.2	1844.2	3498.4	3688.4	800	1767.8	1862.8	3535.6	3725.6
520	1711.8	1806.8	3423.6	3613.6	614	1730.6	1825.6	3461.2	3651.2	708	1749.4	1844.4	3498.8	3688.8	801	1768.0	1863.0	3536.0	3726.0
521	1712.0	1807.0	3424.0	3614.0	615	1730.8	1825.8	3461.6	3651.6	709	1749.6	1844.6	3499.2	3689.2	802	1768.2	1863.2	3536.4	3726.4
522	1712.2	1807.2	3424.4	3614.4	616	1731.0	1826.0	3462.0	3652.0	710	1749.8	1844.8	3499.6	3689.6	803	1768.4	1863.4	3536.8	3726.8
523	1712.4	1807.4	3424.8	3614.8	617	1731.2	1826.2	3462.4	3652.4	711	1750.0	1845.0	3500.0	3690.0	804	1768.6	1863.6	3537.2	3727.2
524	1712.6	1807.6	3425.2	3615.2	618	1731.4	1826.4	3462.8	3652.8	712	1750.2	1845.2	3500.4	3690.4	805	1768.8	1863.8	3537.6	3727.6
525	1712.8	1807.8	3425.6	3615.6	619	1731.6	1826.6	3463.2	3653.2	713	1750.4	1845.4	3500.8	3690.8	806	1769.0	1864.0	3538.0	3728.0
526	1713.0	1808.0	3426.0	3616.0	620	1731.8	1826.8	3463.6	3653.6	714	1750.6	1845.6	3501.2	3691.2	807	1769.2	1864.2	3538.4	3728.4
527	1713.2	1808.2	3426.4	3616.4	621	1732.0	1827.0	3464.0	3654.0	715	1750.8	1845.8	3501.6	3691.6	808	1769.4	1864.4	3538.8	3728.8
528	1713.4	1808.4	3426.8	3616.8	622	1732.2	1827.2	3464.4	3654.4	716	1751.0	1846.0	3502.0	3692.0	809	1769.6	1864.6	3539.2	3729.2
529	1713.6	1808.6	3427.2	3617.2	623	1732.4	1827.4	3464.8	3654.8	717	1751.2	1846.2	3502.4	3692.4	810	1769.8	1864.8	3539.6	3729.6
530	1713.8	1808.8	3427.6	3617.6	624	1732.6	1827.6	3465.2	3655.2	718	1751.4	1846.4	3502.8	3692.8	811	1770.0	1865.0	3540.0	3730.0
531	1714.0	1809.0	3428.0	3618.0	625	1732.8	1827.8	3465.6	3655.6	719	1751.6	1846.6	3503.2	3693.2	812	1770.2	1865.2	3540.4	3730.4
532	1714.2	1809.2	3428.4	3618.4	626	1733.0	1828.0	3466.0	3656.0	720	1751.8	1846.8	3503.6	3693.6	813	1770.4	1865.4	3540.8	3730.8
533	1714.4	1809.4	3428.8	3618.8	627	1733.2	1828.2	3466.4	3656.4	721	1752.0	1847.0	3504.0	3694.0	814	1770.6	1865.6	3541.2	3731.2
534	1714.6	1809.6	3429.2	3619.2	628	1733.4	1828.4	3466.8	3656.8	722	1752.2	1847.2	3504.4	3694.4	815	1770.8	1865.8	3541.6	3731.6
535	1714.8	1809.8	3429.6	3619.6	629	1733.6	1828.6	3467.2	3657.2	723	1752.4	1847.4	3504.8	3694.8	816	1771.0	1866.0	3542.0	3732.0
536	1715.0	1810.0	3430.0	3620.0	630	1733.8	1828.8	3467.6	3657.6	724	1752.6	1847.6	3505.2	3695.2	817	1771.2	1866.2	3542.4	3732.4
537	1715.2	1810.2	3430.4	3620.4	631	1734.0	1829.0	3468.0	3658.0	725	1752.8	1847.8	3505.6	3695.6	818	1771.4	1866.4	3542.8	3732.8
538	1715.4	1810.4	3430.8	3620.8	632	1734.2	1829.2	3468.4	3658.4	726	1753.0	1848.0	3506.0	3696.0	819	1771.6	1866.6	3543.2	3733.2
539	1715.6	1810.6	3431.2	3621.2	633	1734.4	1829.4	3468.8	3658.8	727	1753.2	1848.2	3506.4	3696.4	820	1771.8	1866.8	3543.6	3733.6
540	1715.8	1810.8	3431.6	3621.6	634	1734.6	1829.6	3469.2	3659.2	728	1753.4	1848.4	3506.8	3696.8	821	1772.0	1867.0	3544.0	3734.0
541	1716.0	1811.0	3432.0	3622.0	635	1734.8	1829.8	3469.6	3659.6	729	1753.6	1848.6	3507.2	3697.2	822	1772.2	1867.2	3544.4	3734.4
542	1716.2	1811.2	3432.4	3622.4	636	1735.0	1830.0	3470.0	3660.0	730	1753.8	1848.8	3507.6	3697.6	823	1772.4	1867.4	3544.8	3734.8
543	1716.4	1811.4	3432.8	3622.8	637	1735.2	1830.2	3470.4	3660.4	731	1754.0	1849.0	3508.0	3698.0	824	1772.6	1867.6	3545.2	3735.2
544	1716.6	1811.6	3433.2	3623.2	638	1735.4	1830.4	3470.8	3660.8	732	1754.2	1849.2	3508.4	3698.4	825	1772.8	1867.8	3545.6	3735.6
545	1716.8	1811.8	3433.6	3623.6	639	1735.6	1830.6	3471.2	3661.2	733	1754.4	1849.4	3508.8	3698.8	826	1773.0	1868.0	3546.0	3736.0
546	1717.0	1812.0	3434.0	3624.0	640	1735.8	1830.8	3471.6	3661.6	734	1754.6	1849.6	3509.2	3699.2	827	1773.2	1868.2	3546.4	3736.4
547	1717.2	1812.2	3434.4	3624.4	641	1736.0	1831.0	3472.0	3662.0	735	1754.8	1849.8	3509.6	3699.6	828	1773.4	1868.4	3546.8	3736.8
548	1717.4	1812.4	3434.8	3624.8	642	1736.2	1831.2	3472.4	3662.4	736	1755.0	1850.0	3510.0	3700.0	829	1773.6	1868.6	3547.2	3737.2
549	1717.6	1812.6	3435.2	3625.2	643	1736.4	1831.4	3472.8	3662.8	737	1755.2	1850.2	3510.4	3700.4	830	1773.8	1868.8	3547.6	3737.6
550	1717.8	1812.8	3435.6	3625.6	644	1736.6	1831.6	3473.2	3663.2	738	1755.4	1850.4	3510.8	3700.8	831	1774.0	1869.0	3548.0	3738.0
551	1718.0	1813.0	3436.0	3626.0	645	1736.8	1831.8	3473.6	3663.6	739	1755.6	1850.6	3511.2	3701.2	832	1774.2	1869.2	3548.4	3738.4
552	1718.2	1813.2	3436.4	3626.4	646	1737.0	1832.0	3474.0	3664.0	740	1755.8	1850.8	3511.6	3701.6	833	1774.4	1869.4	3548.8	3738.8
553	1718.4	1813.4	3436.8	3626.8	647	1737.2	1832.2	3474.4	3664.4	741	1756.0	1851.0	3512.0	3702.0	834	1774.6	1869.6	3549.2	3739.2
554	1718.6	1813.6	3437.2	3627.2	648	1737.4	1832.4	3474.8	3664.8	742	1756.2	1851.2	3512.4	3702.4	835	1774.8	1869.8	3549.6	3739.6
555	1718.8	1813.8	3437.6	3627.6	649	1737.6	1832.6	3475.2	3665.2	743	1756.4	1851.4	3512.8	3702.8	836	1775.0	1870.0	3550.0	3740.0
556	1719.0	1814.0	3438.0	3628.0	650	1737.8	1832.8	3475.6	3665.6	744	1756.6	1851.6	3513.2	3703.2	837	1775.2	1870.2	3550.4	3740.4
557	1719.2	1814.2	3438.4	3628.4	651	1738.0	1833.0	3476.0	3666.0	745	1756.8	1851.8	3513.6	3703.6	838	1775.4	1870.4	3550.8	3740.8
558	1719.4	1814.4	3438.8	3628.8	652	1738.2	1833.2	3476.4	3666.4	746	1757.0	1852.0	3514.0	3704.0	839	1775.6	1870.6	3551.2	3741.2
559	1719.6	1814.6	3439.2	3629.2	653	1738.4	1833.4	3476.8	3666.8	747	1757.2	1852.2	3514.4	3704.4	840	1775.8	1870.8	3551.6	3741.6
560	1719.8	1814.8	3439.6	3629.6	654	1738.6	1833.6	3477.2	3667.2	748	1757.4	1852.4	3514.8	3704.8	841	1776.0	1871.0	3552.0	3742.0
561	1720.0	1815.0	3440.0	3630.0	655	1738.8	1833.8	3477.6	3667.6	749	1757.6	1852.6	3515.2	3705.2	842	1776.2	1871.2	3552.4	3742.4
562	1720.2	1815.2	3440.4	3630.4	656	1739.0	1834.0	3478.0	3668.0	750	1757.8	1852.8	3515.6	3705.6	843	1776.4	1871.4	3552.8	3742.8
563	1720.4	1815.4	3440.8	3630.8	657	1739.2	1834.2	3478.4	3668.4	751	1758.0	1853.0	3516.0	3706.0	844	1776.6	1871.6	3553.2	3743.2
564	1720.6	1815.6	3441.2	3631.2	658	1739.4	1834.4	3478.8	3668.8	752	1758.2	1853.2	3516.4	3706.4	845	1776.8	1871.8	3553.6	3743.6
565	1720.8	1815.8	3441.6	3631.6	659	1739.6	1834.6	3479.2	3669.2	753	1758.4	1853.4	3516.8	3706.8	846	1777.0	1872.0	3554.0	3744.0
566	1721.0	1816.0	3442.0	3632.0	660	1739.8	1834.8	3479.6	3669.6	754	1758.6	1853.6	3517.2	3707.2	847	1777.2	1872.2	3554.4	3744.4
567	1721.2	1816.2	3442.4	3632.4	661	1740.0	1835.0	3480.0	3670.0	755	1758.8	1853.8	3517.6	3707.6	848	1777.4	1872.4	3554.8	3744.8
568	1721.4	1816.4	3442.8	3632.8	662	1740.2	1835.2	3480.4	3670.4	756	1759.0	1854.0	3518.0	3708.0	849	1777.6	1872.6	3555.2	3745.2
569	1721.6	1816.6	3443.2	3633.2	663	1740.4	1835.4	3480.8	3670.8	757	1759.2	1854.2	3518.4	3708.4	850	1777.8	1872.8	3555.6	3745.6
570	1721.8	1816.8	3443.6	3633.6	664	1740.6	1835.6	3481.2	3671.2	758	1759.4	1854.4	3518.8	3708.8	851	1778.0	1873.0	3556.0	3746.0
571	1722.0	1817.0	3444.0	3634.0	665	1740.8	1835.8	3481.6	3671.6	759	1759.6	1854.6	3519.2	3709.2	852	1778.2	1873.2	3556.4	3746.4
572	1722.2	1817.2	3444.4	3634.4	666	1741.0	1836.0	3482.0	3672.0	760	1759.8	1854.8	3519.6	3709.6	853	1778.4	1873.4	3556.8	3746.8
573	1722.4	1817.4	3444.8	3634.8	667	1741.2	1836.2	3482.4	3672.4	761	1760.0	1855.0	3520.0	3710.0	854	1778.6	1873.6	3557.2	3747.2
574	1722.6	1817.6	3445.2	3635.2	668	1741.4	1836.4	3482.8	3672.8	762	1760.2	1855.2	3520.4	3710.4	855	1778.8	1873.8	3557.6	3747.6
575	1722.8	1817.8	3445.6	3635.6	669	1741.6	1836.6	3483.2	3673.2	763	1760.4	1855.4	3520.8	3710.8	856	1779.0	1874.0	3558.0	3748.0
576	1723.0	1818.0	3446.0	3636.0	670	1741.8	1836.8	3483.6	3673.6	764	1760.6	1855.6	3521.2	3711.2	857	1779.2	1874.2	3558.4	3748.4
577	1723.2	1818.2	3446.4	3636.4	671	1742.0	1837.0	3484.0	3674.0	765	1760.8	1855.8	3521.6	3711.6	858	1779.4	1874.4	3558.8	3748.8
578	1723.4	1818.4	3446.8	3636.8	672	1742.2	1837.2	3484.4	3674.4	766	1761.0	1856.0	3522.0	3712.0	859	1779.6	1874.6	3559.2	3749.2
579	1723.6	1818.6	3447.2	3637.2	673	1742.4	1837.4	3484.8	3674.8	767	1761.2	1856.2	3522.4	3712.4	860	1779.8	1874.8	3559.6	3749.6
580	1723.8	1818.8	3447.6	3637.6	674	1742.6	1837.6	3485.2	3675.2	768	1761.4	1856.4	3522.8	3712.8	861	1780.0	1875.0	3560.0	3750.0
581	1724.0	1819.0	3448.0	3638.0	675	1742.8	1837.8	3485.6	3675.6	769	1761.6	1856.6	3523.2	3713.2	862	1780.2	1875.2	3560.4	3750.4
582	1724.2	1819.2	3448.4	3638.4	676	1743.0	1838.0	3486.0	3676.0	770	1761.8	1856.8	3523.6	3713.6	863	1780.4	1875.4	3560.8	3750.8
583	1724.4	1819.4	3448.8	3638.8	677	1743.2	1838.2	3486.4	3676.4	771	1762.0	1857.0	3524.0	3714.0	864	1780.6	1875.6	3561.2	3751.2
584	1724.6	1819.6	3449.2	3639.2	678	1743.4	1838.4	3486.8	3676.8	772	1762.2	1857.2	3524.4	3714.4	865	1780.8	1875.8	3561.6	3751.6
585	1724.8	1819.8	3449.6	3639.6	679	1743.6	1838.6	3487.2	3677.2	773	1762.4	1857.4	3524.8	3714.8	866	1781.0	1876.0	3562.0	3752.0
586	1725.0	1820.0	3450.0	3640.0	680	1743.8	1838.8	3487.6	3677.6	774	1762.6	1857.6	3525.2	3715.2	867	1781.2	1876.2	3562.4	3752.4
587	1725.2	1820.2	3450.4	3640.4	681	1744.0	1839.0	3488.0	3678.0	775	1762.8	1857.8	3525.6	3715.6	868	1781.4	1876.4	3562.8	3752.8
588	1725.4	1820.4	3450.8	3640.8	682	1744.2	1839.2	3488.4	3678.4	776	1763.0	1858.0	3526.0	3716.0	869	1781.6	1876.6	3563.2	3753.2
589	1725.6	1820.6	3451.2	3641.2	683	1744.4	1839.4	3488.8	3678.8	777	1763.2	1858.2	3526.4	3716.4	870	1781.8	1876.8	3563.6	3753.6
590	1725.8	1820.8	3451.6	3641.6	684	1744.6	1839.6	3489.2	3679.2	778	1763.4	1858.4	3526.8	3716.8	871	1782.0	1877.0	3564.0	3754.0
591	1726.0	1821.0	3452.0	3642.0	685	1744.8	1839.8	3489.6	3679.6	779	1763.6	1858.6	3527.2	3717.2	872	1782.2	1877.2	3564.4	3754.4
592	1726.2	1821.2	3452.4	3642.4	686	1745.0	1840.0	3490.0	3680.0	780	1763.8	1858.8	3527.6	3717.6	873	1782.4	1877.4	3564.8	3754.8
593	1726.4	1821.4	3452.8	3642.8	687	1745.2	1840.2	3490.4	3680.4	781	1764.0	1859.0	3528.0	3718.0	874	1782.6	1877.6	3565.2	3755.2
594	1726.6	1821.6	3453.2	3643.2	688	1745.4	1840.4	3490.8	3680.8	782	1764.2	1859.2	3528.4	3718.4	875	1782.8	1877.8	3565.6	3755.6
595	1726.8	1821.8	3453.6	3643.6	689	1745.6	1840.6	3491.2	3681.2	783	1764.4	1859.4	3528.8	3718.8	876	1783.0	1878.0	3566.0	3756.0
596	1727.0	1822.0	3454.0	3644.0	690	1745.8	1840.8	3491.6	3681.6	784	1764.6	1859.6	3529.2	3719.2	877	1783.2	1878.2	3566.4	3756.4
597	1727.2	1822.2	3454.4	3644.4	691	1746.0	1841.0	3492.0	3682.0	785	1764.8	1859.8	3529.6	3719.6	878	1783.4	1878.4	3566.8	3756.8
598	1727.4	1822.4	3454.8	3644.8	692	1746.2	1841.2	3492.4	3682.4	786	1765.0	1860.0	3530.0	3720.0	879	1783.6	1878.6	3567.2	3757.2
599	1727.6	1822.6	3455.2	3645.2	693	1746.4	1841.4	3492.8	3682.8	787	1765.2	1860.2	3530.4	3720.4	880	1783.8	1878.8	3567.6	3757.6
600	1727.8	1822.8	3455.6	3645.6	694	1746.6	1841.6	3493.2	3683.2	788	1765.4	1860.4	3530.8	3720.8	881	1784.0	1879.0	3568.0	3758.0
601	1728.0	1823.0	3456.0	3646.0	695	1746.8	1841.8	3493.6	3683.6	789	1765.6	1860.6	3531.2	3721.2	882	1784.2	1879.2	3568.4	3758.4
602	1728.2	1823.2	3456.4	3646.4	696	1747.0	1842.0	3494.0	3684.0	790	1765.8	1860.8	3531.6	3721.6	883	1784.4	1879.4	3568.8	3758.8
603	1728.4	1823.4	3456.8	3646.8	697	1747.2	1842.2	3494.4	3684.4	791	1766.0	1861.0	3532.0	3722.0	884	1784.6	1879.6	3569.2	3759.2
604	1728.6	1823.6	3457.2	3647.2	698	1747.4	1842.4	3494.8	3684.8	792	1766.2	1861.2	3532.4	3722.4	885	1784.8	1879.8	3569.6	3759.6
605	1728.8	1823.8	3457.6	3647.6	699	1747.6	1842.6	3495.2	3685.2										

GSM1900 frequencies



CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
512	1850,2	1930,2	3700,4	3860,4	606	1869,0	1949,0	3738,0	3898,0	700	1887,8	1967,8	3775,6	3935,6	794	1906,6	1986,6	3813,2	3973,2
513	1850,4	1930,4	3700,8	3860,8	607	1869,2	1949,2	3738,4	3898,4	701	1888,0	1968,0	3776,0	3936,0	795	1906,8	1986,8	3813,6	3973,6
514	1850,6	1930,6	3701,2	3861,2	608	1869,4	1949,4	3738,8	3898,8	702	1888,2	1968,2	3776,4	3936,4	796	1907,0	1987,0	3814,0	3974,0
515	1850,8	1930,8	3701,6	3861,6	609	1869,6	1949,6	3739,2	3899,2	703	1888,4	1968,4	3776,8	3936,8	797	1907,2	1987,2	3814,4	3974,4
516	1851,0	1931,0	3702,0	3862,0	610	1869,8	1949,8	3739,6	3899,6	704	1888,6	1968,6	3777,2	3937,2	798	1907,4	1987,4	3814,8	3974,8
517	1851,2	1931,2	3702,4	3862,4	611	1870,0	1950,0	3740,0	3900,0	705	1888,8	1968,8	3777,6	3937,6	799	1907,6	1987,6	3815,2	3975,2
518	1851,4	1931,4	3702,8	3862,8	612	1870,2	1950,2	3740,4	3900,4	706	1889,0	1969,0	3778,0	3938,0	800	1907,8	1987,8	3815,6	3975,6
519	1851,6	1931,6	3703,2	3863,2	613	1870,4	1950,4	3740,8	3900,8	707	1889,2	1969,2	3778,4	3938,4	801	1908,0	1988,0	3816,0	3976,0
520	1851,8	1931,8	3703,6	3863,6	614	1870,6	1950,6	3741,2	3901,2	708	1889,4	1969,4	3778,8	3938,8	802	1908,2	1988,2	3816,4	3976,4
521	1852,0	1932,0	3704,0	3864,0	615	1870,8	1950,8	3741,6	3901,6	709	1889,6	1969,6	3779,2	3939,2	803	1908,4	1988,4	3816,8	3976,8
522	1852,2	1932,2	3704,4	3864,4	616	1871,0	1951,0	3742,0	3902,0	710	1889,8	1969,8	3779,6	3939,6	804	1908,6	1988,6	3817,2	3977,2
523	1852,4	1932,4	3704,8	3864,8	617	1871,2	1951,2	3742,4	3902,4	711	1890,0	1970,0	3780,0	3940,0	805	1908,8	1988,8	3817,6	3977,6
524	1852,6	1932,6	3705,2	3865,2	618	1871,4	1951,4	3742,8	3902,8	712	1890,2	1970,2	3780,4	3940,4	806	1909,0	1989,0	3818,0	3978,0
525	1852,8	1932,8	3705,6	3865,6	619	1871,6	1951,6	3743,2	3903,2	713	1890,4	1970,4	3780,8	3940,8	807	1909,2	1989,2	3818,4	3978,4
526	1853,0	1933,0	3706,0	3866,0	620	1871,8	1951,8	3743,6	3903,6	714	1890,6	1970,6	3781,2	3941,2	808	1909,4	1989,4	3818,8	3978,8
527	1853,2	1933,2	3706,4	3866,4	621	1872,0	1952,0	3744,0	3904,0	715	1890,8	1970,8	3781,6	3941,6	809	1909,6	1989,6	3819,2	3979,2
528	1853,4	1933,4	3706,8	3866,8	622	1872,2	1952,2	3744,4	3904,4	716	1891,0	1971,0	3782,0	3942,0	810	1909,8	1989,8	3819,6	3979,6
529	1853,6	1933,6	3707,2	3867,2	623	1872,4	1952,4	3744,8	3904,8	717	1891,2	1971,2	3782,4	3942,4					
530	1853,8	1933,8	3707,6	3867,6	624	1872,6	1952,6	3745,2	3905,2	718	1891,4	1971,4	3782,8	3942,8					
531	1854,0	1934,0	3708,0	3868,0	625	1872,8	1952,8	3745,6	3905,6	719	1891,6	1971,6	3783,2	3943,2					
532	1854,2	1934,2	3708,4	3868,4	626	1873,0	1953,0	3746,0	3906,0	720	1891,8	1971,8	3783,6	3943,6					
533	1854,4	1934,4	3708,8	3868,8	627	1873,2	1953,2	3746,4	3906,4	721	1892,0	1972,0	3784,0	3944,0					
534	1854,6	1934,6	3709,2	3869,2	628	1873,4	1953,4	3746,8	3906,8	722	1892,2	1972,2	3784,4	3944,4					
535	1854,8	1934,8	3709,6	3869,6	629	1873,6	1953,6	3747,2	3907,2	723	1892,4	1972,4	3784,8	3944,8					
536	1855,0	1935,0	3710,0	3870,0	630	1873,8	1953,8	3747,6	3907,6	724	1892,6	1972,6	3785,2	3945,2					
537	1855,2	1935,2	3710,4	3870,4	631	1874,0	1954,0	3748,0	3908,0	725	1892,8	1972,8	3785,6	3945,6					
538	1855,4	1935,4	3710,8	3870,8	632	1874,2	1954,2	3748,4	3908,4	726	1893,0	1973,0	3786,0	3946,0					
539	1855,6	1935,6	3711,2	3871,2	633	1874,4	1954,4	3748,8	3908,8	727	1893,2	1973,2	3786,4	3946,4					
540	1855,8	1935,8	3711,6	3871,6	634	1874,6	1954,6	3749,2	3909,2	728	1893,4	1973,4	3786,8	3946,8					
541	1856,0	1936,0	3712,0	3872,0	635	1874,8	1954,8	3749,6	3909,6	729	1893,6	1973,6	3787,2	3947,2					
542	1856,2	1936,2	3712,4	3872,4	636	1875,0	1955,0	3750,0	3910,0	730	1893,8	1973,8	3787,6	3947,6					
543	1856,4	1936,4	3712,8	3872,8	637	1875,2	1955,2	3750,4	3910,4	731	1894,0	1974,0	3788,0	3948,0					
544	1856,6	1936,6	3713,2	3873,2	638	1875,4	1955,4	3750,8	3910,8	732	1894,2	1974,2	3788,4	3948,4					
545	1856,8	1936,8	3713,6	3873,6	639	1875,6	1955,6	3751,2	3911,2	733	1894,4	1974,4	3788,8	3948,8					
546	1857,0	1937,0	3714,0	3874,0	640	1875,8	1955,8	3751,6	3911,6	734	1894,6	1974,6	3789,2	3949,2					
547	1857,2	1937,2	3714,4	3874,4	641	1876,0	1956,0	3752,0	3912,0	735	1894,8	1974,8	3789,6	3949,6					
548	1857,4	1937,4	3714,8	3874,8	642	1876,2	1956,2	3752,4	3912,4	736	1895,0	1975,0	3790,0	3950,0					
549	1857,6	1937,6	3715,2	3875,2	643	1876,4	1956,4	3752,8	3912,8	737	1895,2	1975,2	3790,4	3950,4					
550	1857,8	1937,8	3715,6	3875,6	644	1876,6	1956,6	3753,2	3913,2	738	1895,4	1975,4	3790,8	3950,8					
551	1858,0	1938,0	3716,0	3876,0	645	1876,8	1956,8	3753,6	3913,6	739	1895,6	1975,6	3791,2	3951,2					
552	1858,2	1938,2	3716,4	3876,4	646	1877,0	1957,0	3754,0	3914,0	740	1895,8	1975,8	3791,6	3951,6					
553	1858,4	1938,4	3716,8	3876,8	647	1877,2	1957,2	3754,4	3914,4	741	1896,0	1976,0	3792,0	3952,0					
554	1858,6	1938,6	3717,2	3877,2	648	1877,4	1957,4	3754,8	3914,8	742	1896,2	1976,2	3792,4	3952,4					
555	1858,8	1938,8	3717,6	3877,6	649	1877,6	1957,6	3755,2	3915,2	743	1896,4	1976,4	3792,8	3952,8					
556	1859,0	1939,0	3718,0	3878,0	650	1877,8	1957,8	3755,6	3915,6	744	1896,6	1976,6	3793,2	3953,2					
557	1859,2	1939,2	3718,4	3878,4	651	1878,0	1958,0	3756,0	3916,0	745	1896,8	1976,8	3793,6	3953,6					
558	1859,4	1939,4	3718,8	3878,8	652	1878,2	1958,2	3756,4	3916,4	746	1897,0	1977,0	3794,0	3954,0					
559	1859,6	1939,6	3719,2	3879,2	653	1878,4	1958,4	3756,8	3916,8	747	1897,2	1977,2	3794,4	3954,4					
560	1859,8	1939,8	3719,6	3879,6	654	1878,6	1958,6	3757,2	3917,2	748	1897,4	1977,4	3794,8	3954,8					
561	1860,0	1940,0	3720,0	3880,0	655	1878,8	1958,8	3757,6	3917,6	749	1897,6	1977,6	3795,2	3955,2					
562	1860,2	1940,2	3720,4	3880,4	656	1879,0	1959,0	3758,0	3918,0	750	1897,8	1977,8	3795,6	3955,6					
563	1860,4	1940,4	3720,8	3880,8	657	1879,2	1959,2	3758,4	3918,4	751	1898,0	1978,0	3796,0	3956,0					
564	1860,6	1940,6	3721,2	3881,2	658	1879,4	1959,4	3758,8	3918,8	752	1898,2	1978,2	3796,4	3956,4					
565	1860,8	1940,8	3721,6	3881,6	659	1879,6	1959,6	3759,2	3919,2	753	1898,4	1978,4	3796,8	3956,8					
566	1861,0	1941,0	3722,0	3882,0	660	1879,8	1959,8	3759,6	3919,6	754	1898,6	1978,6	3797,2	3957,2					
567	1861,2	1941,2	3722,4	3882,4	661	1880,0	1960,0	3760,0	3920,0	755	1898,8	1978,8	3797,6	3957,6					
568	1861,4	1941,4	3722,8	3882,8	662	1880,2	1960,2	3760,4	3920,4	756	1899,0	1979,0	3798,0	3958,0					
569	1861,6	1941,6	3723,2	3883,2	663	1880,4	1960,4	3760,8	3920,8	757	1899,2	1979,2	3798,4	3958,4					
570	1861,8	1941,8	3723,6	3883,6	664	1880,6	1960,6	3761,2	3921,2	758	1899,4	1979,4	3798,8	3958,8					
571	1862,0	1942,0	3724,0	3884,0	665	1880,8	1960,8	3761,6	3921,6	759	1899,6	1979,6	3799,2	3959,2					
572	1862,2	1942,2	3724,4	3884,4	666	1881,0	1961,0	3762,0	3922,0	760	1899,8	1979,8	3799,6	3959,6					
573	1862,4	1942,4	3724,8	3884,8	667	1881,2	1961,2	3762,4	3922,4	761	1900,0	1980,0	3800,0	3960,0					
574	1862,6	1942,6	3725,2	3885,2	668	1881,4	1961,4	3762,8	3922,8	762	1900,2	1980,2	3800,4	3960,4					
575	1862,8	1942,8	3725,6	3885,6	669	1881,6	1961,6	3763,2	3923,2	763	1900,4	1980,4	3800,8	3960,8					
576	1863,0	1943,0	3726,0	3886,0	670	1881,8	1961,8	3763,6	3923,6	764	1900,6	1980,6	3801,2	3961,2					
577	1863,2	1943,2	3726,4	3886,4	671	1882,0	1962,0	3764,0	3924,0	765	1900,8	1980,8	3801,6	3961,6					
578	1863,4	1943,4	3726,8	3886,8	672	1882,2	1962,2	3764,4	3924,4	766	1901,0	1981,0	3802,0	3962,0					
579	1863,6	1943,6	3727,2	3887,2	673	1882,4	1962,4	3764,8	3924,8	767	1901,2	1981,2	3802,4	3962,4					
580	1863,8	1943,8	3727,6	3887,6	674	1882,6	1962,6	3765,2	3925,2	768	1901,4	1981,4	3802,8	3962,8					
581	1864,0	1944,0	3728,0	3888,0	675	1882,8	1962,8	3765,6	3925,6	769	1901,6	1981,6	3803,2	3963,2					
582	1864,2	1944,2	3728,4	3888,4	676	1883,0	1963,0	3766,0	3926,0	770	1901,8	1981,8	3803,6	3963,6					
583	1864,4	1944,4	3728,8	3888,8	677	1883,2	1963,2	3766,4	3926,4	771	1902,0	1982,0	3804,0	3964,0					
584	1864,6	1944,6	3729,2	3889,2	678	1883,4	1963,4	3766,8	3926,8	772	1902,2	1982,2	3804,4	3964,4					
585	1864,8	1944,8	3729,6	3889,6	679	1883,6	1963,6	3767,2	3927,2	773	1902,4	1982,4	3804,8	3964,8					
586	1865,0	1945,0	3730,0	3890,0	680	1883,8	1963,8	3767,6	3927,6	774	1902,6	1982,6	3805,2	3965,2					
587	1865,2	1945,2	3730,4	3890,4	681	1884,0	1964,0	3768,0	3928,0	775	1902,8	1982,8	3805,6	3965,6					
588	1865,4	1945,4	3730,8	3890,8	682	1884,2	1964,2	3768,4	3928,4	776	1903,0	1983,0	3806,0	3966,0					
589	1865,6	1945,6	3731,2	3891,2	683	1884,4	1964,4	3768,8	3928,8	777	1903,2	1983,2	3806,4	3966,4					
590	1865,8	1945,8	3731,6	3891,6	684	1884,6	1964,6	3769,2	3929,2	778	1903,4	1983,4	3806,8	3966,8					
591	1866,0	1946,0	3732,0	3892,0	685	1884,8	1964,8	3769,6	3929,6	779	1903,6	1983,6	3807,2	3967,2					
592	1866,2	1946,2	3732,4	3892,4	686	1885,0	1965,0	3770,0	3930,0	780	1903,8	1983,8	3807,6	3967,6					
593	1866,4	1946,4	3732,8	3892,8	687	1885,2	1965,2	3770,4	3930,4	781	1904,0	1984,0	3808,0	3968,0					
594	1866,6	1946,6	3733,2	3893,2	688	1885,4	1965,4	3770,8	3930,8	782	1904,2	1984,2	3808,4	3968,4					
595	1866,8	1946,8	3733,6	3893,6	689	1885,6	1965,6	3771,2	3931,2	783	1904,4	1984,4	3808,8	3968,8					
596	1867,0	1947,0	3734,0	3894,0	690	1885,8	1965,8	3771,6	3931,6	784	1904,6	1984,6	3809,2	3969,2					
597	1867,2	1947,2	3734,4	3894,4	691	1886,0	1966,0	3772,0	3932,0	785	1904,8	1984,8	3809,6	3969,6					
598	1867,4	1947,4	3734,8	3894,8	692	1886,2	1966,2	3772,4	3932,4	786	1905,0	1985,0	3810,0	3970,0					
599	1867,6	1947,6	3735,2	3895,2	693	1886,4	1966,4	3772,8	3932,8	787	1905,2	1985,2	3810,4	3970,4					
600	1867,8	1947,8	3735,6	3895,6	694	1886,6	1966,6	3773,2	3933,2	788	1905,4	1985,4	3810,8	3970,8					
601	1868,0	1948,0	3736,0	3896,0	695	1886,8	1966,8	3773,6	3933,6	789	1905,6	1985,6	3811,2	3971,2					
602	1868,2	1948,2	3736,4	3896,4	696	1887,0	1967,0	3774,0	3934,0	790	1905,8	1985,8	3811,6	3971,6					
603	1868,4	1948,4	3736,8	3896,8	697	1887,2	1967,2	3774,4	3934,4	791	1906,0	1986,0	3812,0	3972,0					
604	1868,6	1948,6	3737,2	3897,2	698	1887,4	1967,4	3774,8	3934,8	792	1906,2	1986,2	3812,4	3972,4					
605	1868,8	1948,8	3737,6	3897,6	699	1887,6	1967,6	3775,2	3935,2	793	1906,4	1986,4	3812,8	3972,8					

WCDMA V (850) frequencies

TX CH	RX CH	TX	RX	VCO TX	VCO RX
4132	4357	826.4	871.4	3305.6	3485.6
782	1007	826.5	871.5	3306.0	3486.0
4133	4358	826.6	871.6	3306.4	3486.4
4134	4359	826.8	871.8	3307.2	3487.2
4135	4360	827.0	872.0	3308.0	3488.0
4136	4361	827.2	872.2	3308.8	3488.8
4137	4362	827.4	872.4	3309.6	3489.6
787	1012	827.5	872.5	3310.0	3490.0
4138	4363	827.6	872.6	3310.4	3490.4
4139	4364	827.8	872.8	3311.2	3491.2
4140	4365	828.0	873.0	3312.0	3492.0
4141	4366	828.2	873.2	3312.8	3492.8
4142	4367	828.4	873.4	3313.6	3493.6
4143	4368	828.6	873.6	3314.4	3494.4
4144	4369	828.8	873.8	3315.2	3495.2
4145	4370	829.0	874.0	3316.0	3496.0
4146	4371	829.2	874.2	3316.8	3496.8
4147	4372	829.4	874.4	3317.6	3497.6
4148	4373	829.6	874.6	3318.4	3498.4
4149	4374	829.8	874.8	3319.2	3499.2
4150	4375	830.0	875.0	3320.0	3500.0
4151	4376	830.2	875.2	3320.8	3500.8
4152	4377	830.4	875.4	3321.6	3501.6
4153	4378	830.6	875.6	3322.4	3502.4
4154	4379	830.8	875.8	3323.2	3503.2
4155	4380	831.0	876.0	3324.0	3504.0
4156	4381	831.2	876.2	3324.8	3504.8
4157	4382	831.4	876.4	3325.6	3505.6
807	1032	831.5	876.5	3326.0	3506.0
4158	4383	831.6	876.6	3326.4	3506.4
4159	4384	831.8	876.8	3327.2	3507.2
4160	4385	832.0	877.0	3328.0	3508.0
4161	4386	832.2	877.2	3328.8	3508.8
4162	4387	832.4	877.4	3329.6	3509.6
812	1037	832.5	877.5	3330.0	3510.0
4163	4388	832.6	877.6	3330.4	3510.4
4164	4389	832.8	877.8	3331.2	3511.2
4165	4390	833.0	878.0	3332.0	3512.0
4166	4391	833.2	878.2	3332.8	3512.8
4167	4392	833.4	878.4	3333.6	3513.6
4168	4393	833.6	878.6	3334.4	3514.4
4169	4394	833.8	878.8	3335.2	3515.2
4170	4395	834.0	879.0	3336.0	3516.0
4171	4396	834.2	879.2	3336.8	3516.8
4172	4397	834.4	879.4	3337.6	3517.6
4173	4398	834.6	879.6	3338.4	3518.4
4174	4399	834.8	879.8	3339.2	3519.2
4175	4400	835.0	880.0	3340.0	3520.0
4176	4401	835.2	880.2	3340.8	3520.8
4177	4402	835.4	880.4	3341.6	3521.6
4178	4403	835.6	880.6	3342.4	3522.4
4179	4404	835.8	880.8	3343.2	3523.2
4180	4405	836.0	881.0	3344.0	3524.0
4181	4406	836.2	881.2	3344.8	3524.8
4182	4407	836.4	881.4	3345.6	3525.6
4183	4408	836.6	881.6	3346.4	3526.4
4184	4409	836.8	881.8	3347.2	3527.2
4185	4410	837.0	882.0	3348.0	3528.0
4186	4411	837.2	882.2	3348.8	3528.8
4187	4412	837.4	882.4	3349.6	3529.6
837	1062	837.5	882.5	3350.0	3530.0
4188	4413	837.6	882.6	3350.4	3530.4
4189	4414	837.8	882.8	3351.2	3531.2
4190	4415	838.0	883.0	3352.0	3532.0
4191	4416	838.2	883.2	3352.8	3532.8
4192	4417	838.4	883.4	3353.6	3533.6
4193	4418	838.6	883.6	3354.4	3534.4
4194	4419	838.8	883.8	3355.2	3535.2
4195	4420	839.0	884.0	3356.0	3536.0
4196	4421	839.2	884.2	3356.8	3536.8
4197	4422	839.4	884.4	3357.6	3537.6
4198	4423	839.6	884.6	3358.4	3538.4
4199	4424	839.8	884.8	3359.2	3539.2
4200	4425	840.0	885.0	3360.0	3540.0
4201	4426	840.2	885.2	3360.8	3540.8
4202	4427	840.4	885.4	3361.6	3541.6
4203	4428	840.6	885.6	3362.4	3542.4
4204	4429	840.8	885.8	3363.2	3543.2
4205	4430	841.0	886.0	3364.0	3544.0
4206	4431	841.2	886.2	3364.8	3544.8
4207	4432	841.4	886.4	3365.6	3545.6
4208	4433	841.6	886.6	3366.4	3546.4
4209	4434	841.8	886.8	3367.2	3547.2
4210	4435	842.0	887.0	3368.0	3548.0
4211	4436	842.2	887.2	3368.8	3548.8
4212	4437	842.4	887.4	3369.6	3549.6
862	1087	842.5	887.5	3370.0	3550.0
4213	4438	842.6	887.6	3370.4	3550.4
4214	4439	842.8	887.8	3371.2	3551.2
4215	4440	843.0	888.0	3372.0	3552.0
4216	4441	843.2	888.2	3372.8	3552.8
4217	4442	843.4	888.4	3373.6	3553.6
4218	4443	843.6	888.6	3374.4	3554.4
4219	4444	843.8	888.8	3375.2	3555.2
4220	4445	844.0	889.0	3376.0	3556.0
4221	4446	844.2	889.2	3376.8	3556.8
4222	4447	844.4	889.4	3377.6	3557.6
4223	4448	844.6	889.6	3378.4	3558.4
4224	4449	844.8	889.8	3379.2	3559.2
4225	4450	845.0	890.0	3380.0	3560.0
4226	4451	845.2	890.2	3380.8	3560.8
4227	4452	845.4	890.4	3381.6	3561.6
4228	4453	845.6	890.6	3382.4	3562.4
4229	4454	845.8	890.8	3383.2	3563.2
4230	4455	846.0	891.0	3384.0	3564.0
4231	4456	846.2	891.2	3384.8	3564.8
4232	4457	846.4	891.4	3385.6	3565.6
4233	4458	846.6	891.6	3386.4	3566.4

WCDMA 2100 Rx frequencies

Ch	RX	VCO RX	Ch	RX	VCO RX	Ch	RX	VCO RX	Ch	RX	VCO RX	Ch	RX	VCO RX
10562	2112.4	4224.8	10625	2125	4250	10688	2137.6	4275.2	10751	2150.2	4300.4	10814	2162.8	4325.6
10563	2112.6	4225.2	10626	2125.2	4250.4	10689	2137.8	4275.6	10752	2150.4	4300.8	10815	2163	4326
10564	2112.8	4225.6	10627	2125.4	4250.8	10690	2138	4276	10753	2150.6	4301.2	10816	2163.2	4326.4
10565	2113	4226	10628	2125.6	4251.2	10691	2138.2	4276.4	10754	2150.8	4301.6	10817	2163.4	4326.8
10566	2113.2	4226.4	10629	2125.8	4251.6	10692	2138.4	4276.8	10755	2151	4302	10818	2163.6	4327.2
10567	2113.4	4226.8	10630	2126	4252	10693	2138.6	4277.2	10756	2151.2	4302.4	10819	2163.8	4327.6
10568	2113.6	4227.2	10631	2126.2	4252.4	10694	2138.8	4277.6	10757	2151.4	4302.8	10820	2164	4328
10569	2113.8	4227.6	10632	2126.4	4252.8	10695	2139	4278	10758	2151.6	4303.2	10821	2164.2	4328.4
10570	2114	4228	10633	2126.6	4253.2	10696	2139.2	4278.4	10759	2151.8	4303.6	10822	2164.4	4328.8
10571	2114.2	4228.4	10634	2126.8	4253.6	10697	2139.4	4278.8	10760	2152	4304	10823	2164.6	4329.2
10572	2114.4	4228.8	10635	2127	4254	10698	2139.6	4279.2	10761	2152.2	4304.4	10824	2164.8	4329.6
10573	2114.6	4229.2	10636	2127.2	4254.4	10699	2139.8	4279.6	10762	2152.4	4304.8	10825	2165	4330
10574	2114.8	4229.6	10637	2127.4	4254.8	10700	2140	4280	10763	2152.6	4305.2	10826	2165.2	4330.4
10575	2115	4230	10638	2127.6	4255.2	10701	2140.2	4280.4	10764	2152.8	4305.6	10827	2165.4	4330.8
10576	2115.2	4230.4	10639	2127.8	4255.6	10702	2140.4	4280.8	10765	2153	4306	10828	2165.6	4331.2
10577	2115.4	4230.8	10640	2128	4256	10703	2140.6	4281.2	10766	2153.2	4306.4	10829	2165.8	4331.6
10578	2115.6	4231.2	10641	2128.2	4256.4	10704	2140.8	4281.6	10767	2153.4	4306.8	10830	2166	4332
10579	2115.8	4231.6	10642	2128.4	4256.8	10705	2141	4282	10768	2153.6	4307.2	10831	2166.2	4332.4
10580	2116	4232	10643	2128.6	4257.2	10706	2141.2	4282.4	10769	2153.8	4307.6	10832	2166.4	4332.8
10581	2116.2	4232.4	10644	2128.8	4257.6	10707	2141.4	4282.8	10770	2154	4308	10833	2166.6	4333.2
10582	2116.4	4232.8	10645	2129	4258	10708	2141.6	4283.2	10771	2154.2	4308.4	10834	2166.8	4333.6
10583	2116.6	4233.2	10646	2129.2	4258.4	10709	2141.8	4283.6	10772	2154.4	4308.8	10835	2167	4334
10584	2116.8	4233.6	10647	2129.4	4258.8	10710	2142	4284	10773	2154.6	4309.2	10836	2167.2	4334.4
10585	2117	4234	10648	2129.6	4259.2	10711	2142.2	4284.4	10774	2154.8	4309.6	10837	2167.4	4334.8
10586	2117.2	4234.4	10649	2129.8	4259.6	10712	2142.4	4284.8	10775	2155	4310	10838	2167.6	4335.2
10587	2117.4	4234.8	10650	2130	4260	10713	2142.6	4285.2	10776	2155.2	4310.4			
10588	2117.6	4235.2	10651	2130.2	4260.4	10714	2142.8	4285.6	10777	2155.4	4310.8			
10589	2117.8	4235.6	10652	2130.4	4260.8	10715	2143	4286	10778	2155.6	4311.2			
10590	2118	4236	10653	2130.6	4261.2	10716	2143.2	4286.4	10779	2155.8	4311.6			
10591	2118.2	4236.4	10654	2130.8	4261.6	10717	2143.4	4286.8	10780	2156	4312			
10592	2118.4	4236.8	10655	2131	4262	10718	2143.6	4287.2	10781	2156.2	4312.4			
10593	2118.6	4237.2	10656	2131.2	4262.4	10719	2143.8	4287.6	10782	2156.4	4312.8			
10594	2118.8	4237.6	10657	2131.4	4262.8	10720	2144	4288	10783	2156.6	4313.2			
10595	2119	4238	10658	2131.6	4263.2	10721	2144.2	4288.4	10784	2156.8	4313.6			
10596	2119.2	4238.4	10659	2131.8	4263.6	10722	2144.4	4288.8	10785	2157	4314			
10597	2119.4	4238.8	10660	2132	4264	10723	2144.6	4289.2	10786	2157.2	4314.4			
10598	2119.6	4239.2	10661	2132.2	4264.4	10724	2144.8	4289.6	10787	2157.4	4314.8			
10599	2119.8	4239.6	10662	2132.4	4264.8	10725	2145	4290	10788	2157.6	4315.2			
10600	2120	4240	10663	2132.6	4265.2	10726	2145.2	4290.4	10789	2157.8	4315.6			
10601	2120.2	4240.4	10664	2132.8	4265.6	10727	2145.4	4290.8	10790	2158	4316			
10602	2120.4	4240.8	10665	2133	4266	10728	2145.6	4291.2	10791	2158.2	4316.4			
10603	2120.6	4241.2	10666	2133.2	4266.4	10729	2145.8	4291.6	10792	2158.4	4316.8			
10604	2120.8	4241.6	10667	2133.4	4266.8	10730	2146	4292	10793	2158.6	4317.2			
10605	2121	4242	10668	2133.6	4267.2	10731	2146.2	4292.4	10794	2158.8	4317.6			
10606	2121.2	4242.4	10669	2133.8	4267.6	10732	2146.4	4292.8	10795	2159	4318			
10607	2121.4	4242.8	10670	2134	4268	10733	2146.6	4293.2	10796	2159.2	4318.4			
10608	2121.6	4243.2	10671	2134.2	4268.4	10734	2146.8	4293.6	10797	2159.4	4318.8			
10609	2121.8	4243.6	10672	2134.4	4268.8	10735	2147	4294	10798	2159.6	4319.2			
10610	2122	4244	10673	2134.6	4269.2	10736	2147.2	4294.4	10799	2159.8	4319.6			
10611	2122.2	4244.4	10674	2134.8	4269.6	10737	2147.4	4294.8	10800	2160	4320			
10612	2122.4	4244.8	10675	2135	4270	10738	2147.6	4295.2	10801	2160.2	4320.4			
10613	2122.6	4245.2	10676	2135.2	4270.4	10739	2147.8	4295.6	10802	2160.4	4320.8			
10614	2122.8	4245.6	10677	2135.4	4270.8	10740	2148	4296	10803	2160.6	4321.2			
10615	2123	4246	10678	2135.6	4271.2	10741	2148.2	4296.4	10804	2160.8	4321.6			
10616	2123.2	4246.4	10679	2135.8	4271.6	10742	2148.4	4296.8	10805	2161	4322			
10617	2123.4	4246.8	10680	2136	4272	10743	2148.6	4297.2	10806	2161.2	4322.4			
10618	2123.6	4247.2	10681	2136.2	4272.4	10744	2148.8	4297.6	10807	2161.4	4322.8			
10619	2123.8	4247.6	10682	2136.4	4272.8	10745	2149	4298	10808	2161.6	4323.2			
10620	2124	4248	10683	2136.6	4273.2	10746	2149.2	4298.4	10809	2161.8	4323.6			
10621	2124.2	4248.4	10684	2136.8	4273.6	10747	2149.4	4298.8	10810	2162	4324			
10622	2124.4	4248.8	10685	2137	4274	10748	2149.6	4299.2	10811	2162.2	4324.4			
10623	2124.6	4249.2	10686	2137.2	4274.4	10749	2149.8	4299.6	10812	2162.4	4324.8			
10624	2124.8	4249.6	10687	2137.4	4274.8	10750	2150	4300	10813	2162.6	4325.2			

WCDMA 2100 Tx frequencies

Ch	Tx	VCO Tx	Ch	Tx	VCO Tx	Ch	Tx	VCO Tx	Ch	Tx	VCO Tx	Ch	Tx	VCO Tx
9612	1922.4	3844.8	9671	1934.2	3868.4	9730	1946	3892	9789	1957.8	3915.6	9848	1969.6	3939.2
9613	1922.6	3845.2	9672	1934.4	3868.8	9731	1946.2	3892.4	9790	1958	3916	9849	1969.8	3939.6
9614	1922.8	3845.6	9673	1934.6	3869.2	9732	1946.4	3892.8	9791	1958.2	3916.4	9850	1970	3940
9615	1923	3846	9674	1934.8	3869.6	9733	1946.6	3893.2	9792	1958.4	3916.8	9851	1970.2	3940.4
9616	1923.2	3846.4	9675	1935	3870	9734	1946.8	3893.6	9793	1958.6	3917.2	9852	1970.4	3940.8
9617	1923.4	3846.8	9676	1935.2	3870.4	9735	1947	3894	9794	1958.8	3917.6	9853	1970.6	3941.2
9618	1923.6	3847.2	9677	1935.4	3870.8	9736	1947.2	3894.4	9795	1959	3918	9854	1970.8	3941.6
9619	1923.8	3847.6	9678	1935.6	3871.2	9737	1947.4	3894.8	9796	1959.2	3918.4	9855	1971	3942
9620	1924	3848	9679	1935.8	3871.6	9738	1947.6	3895.2	9797	1959.4	3918.8	9856	1971.2	3942.4
9621	1924.2	3848.4	9680	1936	3872	9739	1947.8	3895.6	9798	1959.6	3919.2	9857	1971.4	3942.8
9622	1924.4	3848.8	9681	1936.2	3872.4	9740	1948	3896	9799	1959.8	3919.6	9858	1971.6	3943.2
9623	1924.6	3849.2	9682	1936.4	3872.8	9741	1948.2	3896.4	9800	1960	3920	9859	1971.8	3943.6
9624	1924.8	3849.6	9683	1936.6	3873.2	9742	1948.4	3896.8	9801	1960.2	3920.4	9860	1972	3944
9625	1925	3850	9684	1936.8	3873.6	9743	1948.6	3897.2	9802	1960.4	3920.8	9861	1972.2	3944.4
9626	1925.2	3850.4	9685	1937	3874	9744	1948.8	3897.6	9803	1960.6	3921.2	9862	1972.4	3944.8
9627	1925.4	3850.8	9686	1937.2	3874.4	9745	1949	3898	9804	1960.8	3921.6	9863	1972.6	3945.2
9628	1925.6	3851.2	9687	1937.4	3874.8	9746	1949.2	3898.4	9805	1961	3922	9864	1972.8	3945.6
9629	1925.8	3851.6	9688	1937.6	3875.2	9747	1949.4	3898.8	9806	1961.2	3922.4	9865	1973	3946
9630	1926	3852	9689	1937.8	3875.6	9748	1949.6	3899.2	9807	1961.4	3922.8	9866	1973.2	3946.4
9631	1926.2	3852.4	9690	1938	3876	9749	1949.8	3899.6	9808	1961.6	3923.2	9867	1973.4	3946.8
9632	1926.4	3852.8	9691	1938.2	3876.4	9750	1950	3900	9809	1961.8	3923.6	9868	1973.6	3947.2
9633	1926.6	3853.2	9692	1938.4	3876.8	9751	1950.2	3900.4	9810	1962	3924	9869	1973.8	3947.6
9634	1926.8	3853.6	9693	1938.6	3877.2	9752	1950.4	3900.8	9811	1962.2	3924.4	9870	1974	3948
9635	1927	3854	9694	1938.8	3877.6	9753	1950.6	3901.2	9812	1962.4	3924.8	9871	1974.2	3948.4
9636	1927.2	3854.4	9695	1939	3878	9754	1950.8	3901.6	9813	1962.6	3925.2	9872	1974.4	3948.8
9637	1927.4	3854.8	9696	1939.2	3878.4	9755	1951	3902	9814	1962.8	3925.6	9873	1974.6	3949.2
9638	1927.6	3855.2	9697	1939.4	3878.8	9756	1951.2	3902.4	9815	1963	3926	9874	1974.8	3949.6
9639	1927.8	3855.6	9698	1939.6	3879.2	9757	1951.4	3902.8	9816	1963.2	3926.4	9875	1975	3950
9640	1928	3856	9699	1939.8	3879.6	9758	1951.6	3903.2	9817	1963.4	3926.8	9876	1975.2	3950.4
9641	1928.2	3856.4	9700	1940	3880	9759	1951.8	3903.6	9818	1963.6	3927.2	9877	1975.4	3950.8
9642	1928.4	3856.8	9701	1940.2	3880.4	9760	1952	3904	9819	1963.8	3927.6	9878	1975.6	3951.2
9643	1928.6	3857.2	9702	1940.4	3880.8	9761	1952.2	3904.4	9820	1964	3928	9879	1975.8	3951.6
9644	1928.8	3857.6	9703	1940.6	3881.2	9762	1952.4	3904.8	9821	1964.2	3928.4	9880	1976	3952
9645	1929	3858	9704	1940.8	3881.6	9763	1952.6	3905.2	9822	1964.4	3928.8	9881	1976.2	3952.4
9646	1929.2	3858.4	9705	1941	3882	9764	1952.8	3905.6	9823	1964.6	3929.2	9882	1976.4	3952.8
9647	1929.4	3858.8	9706	1941.2	3882.4	9765	1953	3906	9824	1964.8	3929.6	9883	1976.6	3953.2
9648	1929.6	3859.2	9707	1941.4	3882.8	9766	1953.2	3906.4	9825	1965	3930	9884	1976.8	3953.6
9649	1929.8	3859.6	9708	1941.6	3883.2	9767	1953.4	3906.8	9826	1965.2	3930.4	9885	1977	3954
9650	1930	3860	9709	1941.8	3883.6	9768	1953.6	3907.2	9827	1965.4	3930.8	9886	1977.2	3954.4
9651	1930.2	3860.4	9710	1942	3884	9769	1953.8	3907.6	9828	1965.6	3931.2	9887	1977.4	3954.8
9652	1930.4	3860.8	9711	1942.2	3884.4	9770	1954	3908	9829	1965.8	3931.6	9888	1977.6	3955.2
9653	1930.6	3861.2	9712	1942.4	3884.8	9771	1954.2	3908.4	9830	1966	3932			
9654	1930.8	3861.6	9713	1942.6	3885.2	9772	1954.4	3908.8	9831	1966.2	3932.4			
9655	1931	3862	9714	1942.8	3885.6	9773	1954.6	3909.2	9832	1966.4	3932.8			
9656	1931.2	3862.4	9715	1943	3886	9774	1954.8	3909.6	9833	1966.6	3933.2			
9657	1931.4	3862.8	9716	1943.2	3886.4	9775	1955	3910	9834	1966.8	3933.6			
9658	1931.6	3863.2	9717	1943.4	3886.8	9776	1955.2	3910.4	9835	1967	3934			
9659	1931.8	3863.6	9718	1943.6	3887.2	9777	1955.4	3910.8	9836	1967.2	3934.4			
9660	1932	3864	9719	1943.8	3887.6	9778	1955.6	3911.2	9837	1967.4	3934.8			
9661	1932.2	3864.4	9720	1944	3888	9779	1955.8	3911.6	9838	1967.6	3935.2			
9662	1932.4	3864.8	9721	1944.2	3888.4	9780	1956	3912	9839	1967.8	3935.6			
9663	1932.6	3865.2	9722	1944.4	3888.8	9781	1956.2	3912.4	9840	1968	3936			
9664	1932.8	3865.6	9723	1944.6	3889.2	9782	1956.4	3912.8	9841	1968.2	3936.4			
9665	1933	3866	9724	1944.8	3889.6	9783	1956.6	3913.2	9842	1968.4	3936.8			
9666	1933.2	3866.4	9725	1945	3890	9784	1956.8	3913.6	9843	1968.6	3937.2			
9667	1933.4	3866.8	9726	1945.2	3890.4	9785	1957	3914	9844	1968.8	3937.6			
9668	1933.6	3867.2	9727	1945.4	3890.8	9786	1957.2	3914.4	9845	1969	3938			
9669	1933.8	3867.6	9728	1945.6	3891.2	9787	1957.4	3914.8	9846	1969.2	3938.4			
9670	1934	3868	9729	1945.8	3891.6	9788	1957.6	3915.2	9847	1969.4	3938.8			

(This page left intentionally blank.)

Glossary

(This page left intentionally blank.)

A/D-converter	Analog-to-digital converter
ACI	Accessory Control Interface
ADC	Analog-to-digital converter
ADSP	Application DPS (expected to run high level tasks)
AGC	Automatic gain control (maintains volume)
ALS	Ambient light sensor
AMSL	After Market Service Leader
ARM	Advanced RISC Machines
ARPU	Average revenue per user (per month or per year)
ASIC	Application Specific Integrated Circuit
ASIP	Application Specific Interface Protector
B2B	Board to board, connector between PWB and UI board
BB	Baseband
BC02	Bluetooth module made by CSR
BIQUAD	Bi-quadratic ,type of filter function)
BSI	Battery Size Indicator
BT	Bluetooth
CBus	MCU controlled serial bus connected to UPP_WD2,UEME and Zocus
CCP	Compact Camera Port
CDSP	Cellular DSP (expected to run at low levels)
CLDC	Connected limited device configuration
CMOS	Complimentary metal-oxide semiconductor circuit (low power consumption)
COF	Chip on Foil
COG	Chip on Glass
CPU	Central Processing Unit
CSR	cambridge silicon radio
CSTN	Color Super Twisted Nematic
CTSI	Clock Timing Sleep and interrupt block of Tiku
CW	Continuous wave
D/A-converter	Digital-to-analouge converter
DAC	Digital-to-analouge converter
DBI	Digital Battery Interface
DBus	DSP controlled serial bus connected between UPP_WD2 and Helgo
DCT-4	Digital Core Technology
DMA	Direct memory access
DP	Data Package

DPLL	Digital Phase Locked Loop
DSP	Digital Signal Processor
DtoS	Differential to Single ended
EDGE	Enhanced data rates for global/GSM evaluation
EGSM	Extended GSM
EM	Energy management
EMC	Electromagnetic compability
EMI	Electromagnetic interference
ESD	Electrostatic discharge
FCI	Functional cover interface
FPS	Flash Programming Tool
FR	Full rate
FSTN	Film compensated super twisted nematic
GMSK	Gaussian Minimum Shift Keying
GND	Ground, conductive mass
GPIB	General-purpose interface bus
GPRS	General Packet Radio Service
GSM	Group Special Mobile/Global System for Mobile communication
HF	Hands free
HFCM	Handsfree Common
HS	Handset
HSCSD	High speed circuit switched data (data transmission connection faster than GSM)
HW	Hardware
I/O	Input/Output
IBAT	Battery current
IC	Integrated circuit
ICHAR	Charger current
IF	Interface
IHF	Integrated hands free
IMEI	International Mobile Equipment Identity
IR	Infrared
IrDA	Infrared Data Associasion
ISA	Intelligent software architecture
JPEG/JPG	Joint Photographic Experts Group
LCD	Liquid Crystal Display
LDO	Low Drop Out

LED	Light-emitting diode
LPRF	Low Power Radio Frequency
MCU	Micro Controller Unit (microprocessor)
MCU	Multiport control unit
MIC, mic	Microphone
MIDP	Mobile Information Device Profile
MIN	Mobile identification number
MIPS	Million instructions per second
MMC	Multimedia card
MMS	Multimedia messaging service
NTC	Negative temperature coefficient, temperature sensitive resistor used as a temperature sensor
OMA	Object management architechture
OMAP	Operations, maintenance, and administartion part
Opamp	Operational Amplifier
PA	Power amplifier
PDA	Pocket Data Application
PDA	Personal digital assistant
PDRAM	Program/Data RAM (on chip in Tiku)
Phoenix	Software tool of DCT4.x
PIM	Personal Information Management
PLL	Phase locked loop
PM	(Phone) Permanent memory
PUP	General Purpose IO (PIO), USARTS and Pulse Width Modulators
PURX	Power-up reset
PWB	Printed Wiring Board
PWM	Pulse width modulation
RC-filter	Resistance-Capacitance filter
RF	Radio Frequency
RF PopPort TM	Reduced function PopPortTM interface
RFBUS	Serial control Bus For RF
RSK	Right Soft Key
RS-MMC	Reduced size Multi Media Card
RSSI	Receiving signal strength indicator
RST	Reset Switch
RTC	Real Time Clock (provides date and time)

RX	Radio Receiver
SARAM	Single Access RAM
SAW filter	Surface Acoustic Wave filter
SDRAM	Synchronous Dynamic Random Access Memory
SID	Security ID
SIM	Subscriber Identity Module
SMPS	Switched Mode Power Supply
SNR	Signal-to-noice ratio
SPR	Standard Product requirements
SRAM	Static random access memory
STI	Serial Trace Interface
SW	Software
SWIM	Subscriber/Wallet Identification Module
TCXO	Temperature controlled Oscillator
Tiku	Finnish for Chip, Successor of the UPP
TX	Radio Transmitter
UART	Universal asynchronous receiver/transmitter
UEME	Universal Energy Management chip (Enhanced version)
UEMEK	See UEME
UI	User Interface
UPP	Universal Phone Processor
UPP_WD2	Communicator version of DCT4 system ASIC
USB	Universal Serial Bus
VBAT	Battery voltage
VCHAR	Charger voltage
VCO	Voltage controlled oscillator
VCTCXO	Voltage Controlled Temperature Compensated Crystal Oscillator
VCXO	Voltage Controlled Crystal Oscillator
Vp-p	Peak-to-peak voltage
VSIM	SIM voltage
WAP	Wireless application protocol
WD	Watchdog
XHTML	Extensible hypertext markup language
Zocus	Current sensor, (used to monitor the current flow to and from the battery)